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ANNUAL REPORT
OF THE
COMMISSIONER OF LIGHTHOUSES

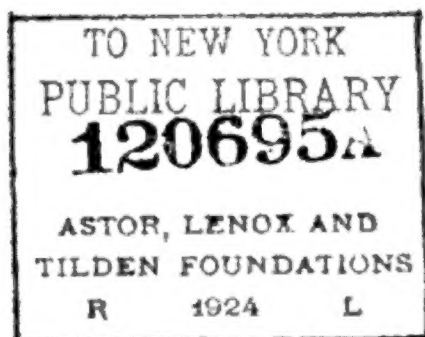
TO THE
SECRETARY OF COMMERCE

FOR THE
FISCAL YEAR ENDED JUNE 30, 1915



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REPORT OF THE COMMISSIONER OF LIGHTHOUSES.

DEPARTMENT OF COMMERCE,
BUREAU OF LIGHTHOUSES,
Washington, September 15, 1915.

SIR: The following report is submitted of the operations of the Lighthouse Service for the fiscal year ended June 30, 1915.

PROGRESS OF THE LIGHTHOUSE SERVICE IN PAST FIVE YEARS.

As a period of five years has passed since the reorganization of the Lighthouse Service under the act of Congress which took effect July 1, 1910, a brief review of the progress of lighthouse work in the United States during that period is given below. The main features of the reorganization law were to provide a more direct administration by placing the Lighthouse Service under a simple bureau form of organization with civilian officers, instead of a board of detailed officers, and by consolidating the work in each lighthouse district under a single officer, the inspectors in all but the three river districts being civilians selected under civil-service requirements.

The total number of aids to navigation on June 30, 1915, was 14,544, as compared with 11,713 on June 30, 1910, representing a total net increase during the five-year period of 2,831, or 24 per cent, an average of 566 per year. For the preceding five-year period, namely, from June 30, 1905, to June 30, 1910, the total increase was 1,793, or an average of 359 per year.

Careful consideration has been given, in the interests of economy and efficiency, to the discontinuance of lights and other aids no longer required by navigation, so that the above figures represent a net increase, after allowing for 2,580 aids to navigation which have been discontinued during the past five years.

In respect to the appropriations for maintenance of the service, attention is invited to the diagram on page 4 comparing the number of aids maintained with the total maintenance appropriations for a period of 15 years from 1901 to 1915.

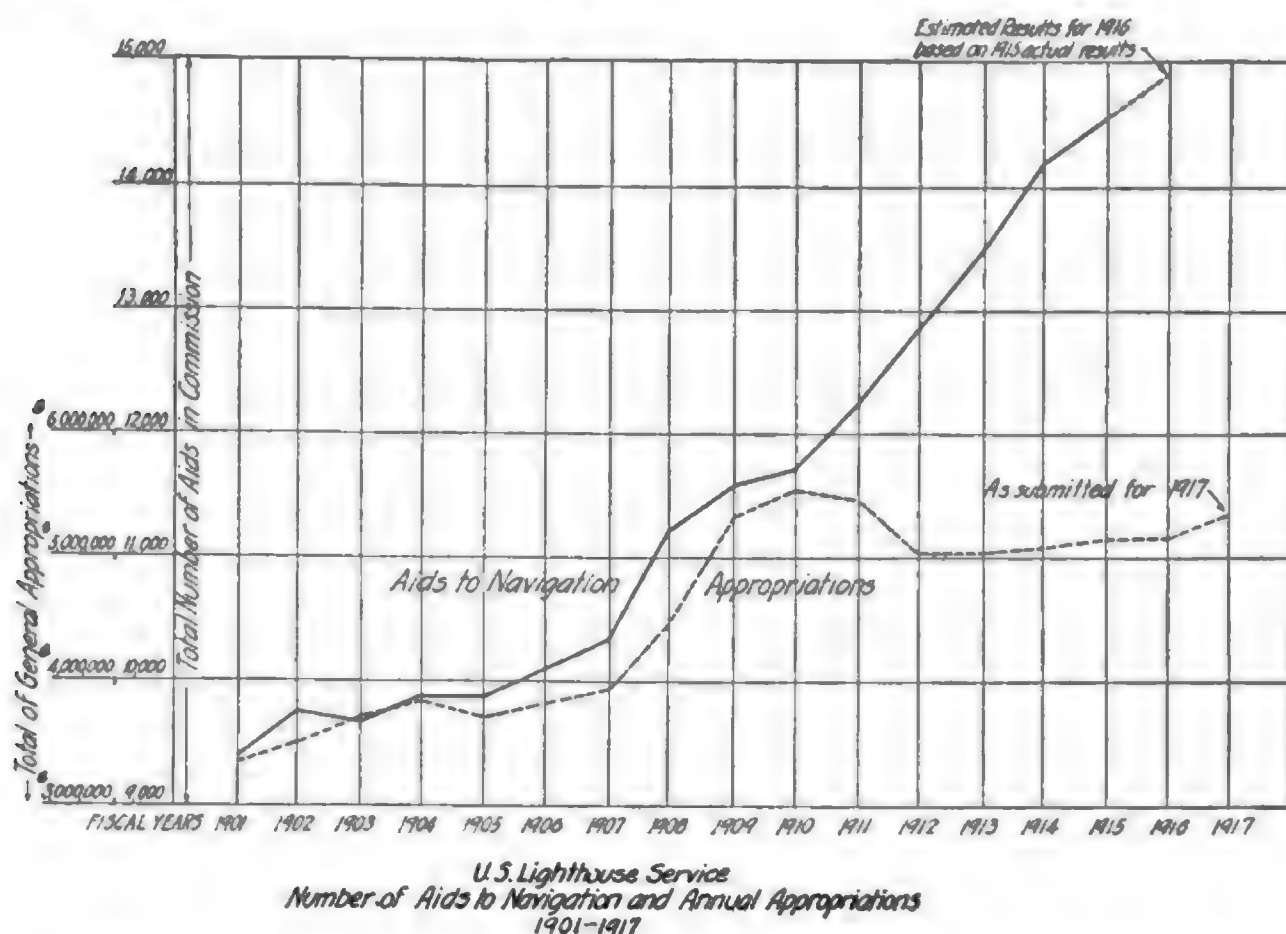
Careful attention has been given to the improvement of apparatus and equipment, in accordance with the best modern practice of coast lighting. Gas buoys, which are more appreciated by mariners than any other recent addition to coast lighting, have been increased from 225 in 1910 to 479 in 1915, a total increase of 254, or 113 per cent.

The use of oil-vapor lamps increases the illuminating power from a given quantity of kerosene oil by about eight times, and these lights have been greatly appreciated because of their superior bril-

liancy. The number of oil-vapor installations at light stations has been increased from 80 in 1910 to 286 in 1915, a total increase of 206 stations, or 257 per cent. Most of the primary coast lights are now provided with oil-vapor lamps.

On the Atlantic coast, of the 70 primary lights, 16 used oil vapor in 1910 and 64 in 1915; on the Pacific coast 2 used oil vapor in 1910 and 32 out of the 34 primary lights used oil vapor in 1915.

Many of the older lights were fixed and did not have a characteristic which would distinguish them from other lights. Steady progress has been made in changing such lights, where doubt might occur, to flashing or occulting, and 169 lights have been so improved in the five-year period just completed. Especially marked progress in this respect has been made on the Pacific coast, where of the primary lights in 1910, 11 were fixed lights, whereas in 1915 only 2 out of 34



are fixed lights; of the total primary lights on the Atlantic and Pacific coasts in 1910, 65 were flashing or occulting and 37 fixed, and in 1915, 80 were flashing or occulting and 24 fixed.

There has been a strong demand for improved lighting of the Alaskan waters, and the number of lights on the coast of Alaska has been increased from 37 in 1910 to 112 in 1915, an increase of 75, or 203 per cent.

The total number of fog signals, including sounding buoys, has increased from 844 in 1910 to 1,044 in 1915, an increase of 200, or 24 per cent. Classified as to types, the increases have been: Fog signals on shore, 498 to 527; whistling buoys, 104 to 149; bell buoys, 200 to 318; submarine bells, 42 to 50.

Although the number of aids to navigation has steadily increased, as shown above, involving an increase in all the operations of the Service, it has been possible to maintain this increased number of aids with a less number of lighthouse tenders, owing to the simpli-

cation of work and concentration of authority under the reorganization. Thus, in 1910 there were 51 lighthouse tenders, in 1913 44 tenders, and in 1915 47 tenders. With the considerable increase of 24 per cent which has been made in the total number of aids to navigation, a gradual increase in tenders has now become necessary. Both for this reason and because of the necessity of replacing tenders as they are worn out in service, 3 tenders are now under construction and estimates are submitted for others.

The number of light vessels and light-vessel stations has diminished by a slight amount, 2 vessels and stations, during this five-year interval, the increase which might normally have been expected having been offset by the large increase in gas buoys, many of them equipped with whistles, bells, and submarine bells, thus supplying important aids to a much larger number of localities and at much less expense than would have been possible with light vessels. There has, however, been a steady construction of new light vessels to replace those worn out in service.

During the five years since 1910 the organization and business methods of the Lighthouse Service have been thoroughly examined and revised wherever it appeared advantageous to do so. Nineteen persons have been appointed as civilian lighthouse inspectors, all selected solely on their technical qualifications; 15 of these were promoted in the Lighthouse Service, where each had served from 5 to 40 years, and the other 4 had had experience of from 8 to 13 years each on other Government vessels engaged in related technical work. The two offices in each district were combined into one, and the office force and the use of the lighthouse tenders rearranged on a business basis. A general inspector and an examiner were appointed, who make periodic inspections of the technical and business methods in each district. A cost-keeping system for the whole Service has been inaugurated. The Regulations and the Instructions have been thoroughly revised. Annual conferences of lighthouse inspectors have been held, and a monthly lighthouse bulletin is issued to the Service. Aids and cadets have been appointed for training in lighthouse engineering and nautical work. The lighthouse publications have been simplified and systematized. Important economies and improvements have been introduced in the use and handling of supplies and accounting for property. The form of appropriations has been simplified. Full cooperation has been arranged between the Lighthouse Service and other branches of the Department of Commerce, other correlated bureaus of the Government, and maritime interests. Radio installations have been made on several tenders, and many improvements of apparatus have been perfected or introduced.

In securing increased efficiency and economy the welfare of the personnel has also been constantly considered. Legislation has been secured providing for compensation for injuries received in hazardous work of the Lighthouse Service, the subsistence arrangements on vessels and the accommodations for crews have been improved, leave of absence has been granted to per diem employees, a medical handbook has been published, and the cooperation of the Public Health Service arranged for. A retirement system has been repeatedly advocated for deserving employees who have earned this consideration.

The present general organization of the Service under the act of June 17, 1910, is briefly as follows:

There is an office in Washington, which is the executive center of the Service, under the Commissioner of Lighthouses and the Deputy Commissioner. There are in this office an engineering construction division, under the chief constructing engineer; a naval construction division, under the superintendent of naval construction; a hydrographic division, under an assistant engineer, and the general office force, under the chief clerk. The Service outside of Washington is divided into 19 lighthouse districts, each under the charge of a lighthouse inspector. In each district there is a central office and one or more lighthouse depots. Each district is provided with lighthouse tenders for distributing supplies to the various stations and light vessels, for transportation of materials for construction or repair, and for care of buoys. In addition, there is in the third lighthouse district, on Staten Island, New York Harbor, a general lighthouse depot, where supplies are purchased in quantities, special apparatus is manufactured or repaired, and various experimental work is conducted.

PERSONNEL.

The following table gives the number of employees (all authorized positions, including some vacancies) of the Lighthouse Service at the end of the fiscal year and a comparison of the totals with those for the previous fiscal year.

EMPLOYEES IN THE LIGHTHOUSE SERVICE ON JUNE 30, 1915.

District.	Inspectors, engineering force, draftsmen, aids, appointed foremen, and mechanics.	Clerks, messengers, janitors, and office laborers.	Depot keepers and assistants, including laborers.	Light keepers and assistants.	Laborers in charge of lights (appropriation "Salaries, keepers of lighthouses").	Laborers in charge of post lights and buoys (appropriation "General expenses").	Custodians of reservations.	Officers and crews on tenders and light vessels.	Field force for construction and repair (registered).	Field force for construction and repair (unregistered).	Total.
Bureau.....	19	26									45
First.....	3	6	1	114	2			89	9	4	228
Second.....	4	4	2	81	10			204	3	5	316
Third.....	22	28	10	178	33	58	2	264	170	44	809
Fourth.....	5	5	3	54	10	12	6	29	5	20	149
Fifth.....	10	9	17	173	95	23	2	237	11	12	589
Sixth.....	5	7	2	56	9	26		117	3	7	232
Seventh.....	2	11	1	43	1			25	5	28	108
Eighth.....	6	7	7	109	23	34		94	7	21	308
Ninth.....	2	5	1	34	1			22	15	6	89
Tenth.....	7	5	2	66	3			33	5	28	149
Eleventh.....	8	6	6	157	11	2	1	102	23	29	345
Twelfth.....	7	6	6	161	2	12	1	90	5	19	309
Thirteenth.....	1	2				324		18			345
Fourteenth.....	1	2				540					543
Fifteenth.....	1	2				404		18			425
Sixteenth.....	5	4	1	29		11		44	2	54	150
Seventeenth.....	5	6	4	78	15	106		104	5	6	329
Eighteenth.....	6	6	7	111	6	4		90	10	19	259
Nineteenth.....	4	3	1	27	2			25		3	65
Total, 1915.....	123	145	71	1,471	226	1,556	12	1,605	278	305	5,792
Total, 1914.....	93	143	56	1,485	211	1,563	13	1,563	227	208	5,562
Increase.....	30	2	15		15			42	51	97	230
Decrease.....				14		7	1				

* The apparent increase from 1914 to 1915 is in part due to the fact that for the former year the actual number of employees is given and for the latter the number of authorized positions.

AIDS TO NAVIGATION.

During the fiscal year ended June 30, 1915, there was a net increase of 359 in the total number of aids to navigation maintained by the Lighthouse Service, including 74 lights above the order of minor lights, 1 light vessel, 8 fog signals, 2 submarine bells, 26 daymarks, 25 lighted buoys, 170 unlighted buoys, and 53 minor lights (including 6 float lights).

Fixed lights were changed to flashing or occulting at 29 stations. The illuminant of 21 lights was changed to incandescent oil vapor, the illuminant of 24 lights (including one light vessel) was changed to acetylene, and the illuminant of 3 lights (including one light vessel) was changed to oil gas. Two new light vessels were established during the year. On June 30, 1915, there were maintained by the Lighthouse Service, 14,544 aids to navigation, including 5,155 lights of all classes, and 577 fog signals (not including whistle and bell buoys), of which 50 are submarine signals. It is believed that the systematic methods of improvement and the use of modern apparatus in increasing the number and brilliancy of aids have been of value to the safety of commerce.

The table following gives a summary of the aids to navigation, under each class, established and discontinued during the fiscal year, and also the net increase, and the number in commission at the end of the fiscal years 1914 and 1915:

Class.	1915			Total June 30—	
	Estab- lished.	Discon- tinued.	Increase.	1914 *	1915
Lighted aids:					
Lights (other than minor lights).....	86	12	74	1,588	1,662
Minor lights.....	162	115	47	2,790	2,837
Light-vessel stations.....	1	.....	1	52	53
Gas buoys.....	54	29	25	454	479
Float lights.....	14	8	6	118	124
Total.....	317	164	153	5,002	5,155
Unlighted aids:					
Fog signals.....	8	.....	8	519	527
Submarine signals.....	4	2	2	48	50
Whistling buoys, unlighted.....	3	3	.....	86	86
Bell buoys, unlighted.....	17	12	5	232	237
Other buoys.....	354	189	165	6,323	6,488
Day beacons.....	142	116	26	1,975	2,001
Total.....	528	322	206	9,183	9,389
Grand total.....	845	486	359	14,185	14,544

* Differences from statistics published in 1914 report are due to minor discrepancies in previous count.

The following are some of the more important aids which have been established or materially improved during the past fiscal year:

New light vessels, with flashing lights and compressed-air fog signals, were established at Poe Reef, Straits of Mackinac, Lake Huron, Mich., and Buffalo Entrance, Lake Erie, N. Y. Both of these were former light-vessel stations, which had been temporarily discontinued, one having been discontinued during the fiscal year.

New light and fog signal stations have been constructed at Brandywine Shoal, Del., and Thimble Shoal, Va., in place of former structures.

A complete new system of lighted aids was established at the approaches to the Cape Cod Canal, Mass.

Important coast lights changed from fixed to flashing or occulting: Cape Sarichef, Unimak Pass, Alaska; Ediz Hook, Juan de Fuca Strait, Wash.; Diamond Head, Oahu, Hawaii; Fowey Rocks and Sombrero Key, Florida Reefs, Fla.

Fog signals established: Gallups Island, Boston Harbor, Mass. (electric bell); Fort McHenry, Baltimore Harbor, Md. (electric bell); Volusia Bar, St. Johns River, Fla. (bell); Point Blunt and Point Stuart, Angel Island, San Francisco Bay, Cal. (electric sirens). The former third-class reed horn at Stratford Shoal (Middle Ground), Long Island Sound, N. Y., was changed to a first-class automatic siren.

Submarine bells established: South Pass gas and whistling buoy, Mississippi Passes, La.; Frying Pan Shoal gas and whistling buoy, N. C.; Martins Reef Light Vessel, No. 89, Lake Huron, Mich.

Important gas buoys established: Buzzards Bay, Mass. (2); Cape Cod Canal approach, Mass. (bell); Cornfield Point, Long Island Sound, Conn. (whistle); Cape Henry, Va. (whistle); Wimble Shoal, north of Cape Hatteras, N. C. (whistle); Fernandina Entrance, Fla.; Smith Shoal, Glama Wreck, and New Ground Rocks, Florida Reefs, Fla. (each with whistle); Point Arenas, Vieques Passage, P. R.; Hein Bank, Juan de Fuca Strait, Wash. (bell); South Channel Columbia River entrance, Oreg. (whistle).

Systems of minor aids and buoyage extensively rearranged or improved in important localities: Hudson River, N. Y.; inland waterway, N. J.; Chincoteague Bay, Va.; Newport News Channel, Va.; inland waterway, Fernandina to St. Johns River, Fla.; Santa Rosa Sound, Fla.; Black Rock Channel, Buffalo Harbor, N. Y.; Klag Bay, Alaska; Grays Harbor, Wash.; Yaquina Bay, Oreg.

Flashing acetylene gas lights established: Stockton Harbor Range, Me. (2 lights); Buzzards Bay, Mass. (12 lights); Egmont Key Range Front, Fla.; North Bank, Cedar Keys, Fla.; Ashtabula Harbor, Ohio (2 lights); Conneaut Breakwater, Ohio; Livingstone Channel, Detroit River, Mich.; Manistique Harbor, Mich.; Saugatuck Harbor, Mich.; Oconto Harbor, Wis.; Rugged Island, Resurrection Bay, Alaska.

The amount of hurricane and ice damage during the fiscal year was relatively small, but a number of unusually heavy winter and spring gales, particularly on the Atlantic coast, damaged various vessels and stations. Among these may be mentioned the Atlantic gales of December 5 to 6, 1914, January 12 to 14, and April 2 to 4, 1915; also the Pacific gale of April 29 to 30, 1915, the total aggregate damage amounting to approximately \$50,000.

The systematic relief of all buoys at least once a year was carried out throughout the Service with a greater degree of completeness than in prior years, particularly in those districts where difficulties had been previously experienced on account of the large number of inaccessible buoys.

A systematic plan was developed of keeping records of extinguishment of various types of automatic gas lights, both on fixed and floating aids, with arrangements for reporting the percentage of nights extinguished as compared to the entire period under observation. This is believed useful in compiling information as to the comparative efficiency of various types in service and the degree of reliance which may be placed on such lights.

Further improvements in publishing notices to mariners were undertaken during the year, by adopting a more concise form, giving only such facts as are of principal interest to the mariner.

The light lists for the Atlantic, Lake, and Pacific coasts were each issued in octavo form, which is believed will increase their usefulness to mariners. Special effort was made to publish the seacoast light lists as soon after the first of the calendar year as possible, and the Lake list was issued immediately prior to the opening of the season of navigation.

New editions of the Regulations for Lighting Bridges, and of the Rules and Regulations Governing Private Aids to Navigation, were issued during the fiscal year.

ALASKA.

The total number of aids to navigation in Alaska, including lights, fog signals, buoys, and daymarks, in commission at the close of the fiscal year ended June 30, 1915, was 338, including 112 lights, representing an increase of 75 lights since June 30, 1910, or 203 per cent. The following table, which gives the total number of aids to navigation on June 30 of each year named, illustrates the progress in establishing aids in the Territory:

Aids.	1910	1911	1912	1913	1914	1915
Lights.....	37	71	85	93	108	112
Fog signals.....	9	10	10	10	10	10
Buoys.....	84	105	132	138	157	167
Daymarks.....	30	29	38	40	44	49
Total.....	160	215	265	279	319	338

The act of October 22, 1913, made an appropriation of \$115,000 for a light and fog-signal station at or near Cape St. Elias, and an item for the establishment of aids to navigation and the improvement of existing aids in Alaska, in the sum of \$60,000, was included in the sundry civil act approved August 1, 1914. Work on both of these objects was started as promptly as conditions would permit, and satisfactory progress on each had been made up to the date of this report.

The act of January 25, 1915, appropriated \$250,000 for the new lighthouse tender *Cedar*, urgently needed for the work of the Service in Alaska. The plans and specifications were prepared as quickly as practicable, in order to take advantage of market conditions, and after due advertisement a contract was awarded on May 4, 1915, for the construction of the vessel. In order to care for the work in Alaska properly during the construction of the *Cedar*, the tender *Kukui*, an able seagoing vessel, was transferred from the Hawaiian Islands to Alaska.

The new tender *Fern*, for service in the inside waters of southeastern Alaska, was completed during the fiscal year and immediately assigned to duty.

GUANTANAMO, SAMOA, AND GUAM.

The aids to navigation in the outlying United States territory at Guantanamo Bay, Cuba, the American Samoan Islands, and the island of Guam are maintained under the supervision of the naval

commandants by means of allotments made from the appropriations for the Lighthouse Service. Reports have been received from naval officers in local charge, indicating that the aids have been properly maintained, at an approximate annual expense as follows: Guantamo, \$3,800; Samoa, \$2,100; Guam, \$600.

ADMINISTRATION METHODS AND ECONOMIES.

A second conference of lighthouse inspectors, authorized by the Secretary, was held during February, 1915. The program followed the same general lines as last year, and the results are believed beneficial to the Service.

A new edition of the Regulations for the Lighthouse Service was approved by the Department and issued, to take effect October 1, 1914. This edition embodies all changes and amendments made since the edition of 1911. At the close of the fiscal year a new edition of the Instructions to Employees, conforming to the revised Regulations, was in proof.

A study was made of the advisability of extending the practice of partial payments to contractors for work of the Lighthouse Service; this being considered desirable to afford relief from hardships occasioned contractors and at the same time to protect the interests of the Government. As a conclusion, revised rules providing for progress payments for 75 per cent of work done, under suitable restrictions and safeguards, were put in effect.

The practice of systematic inspections of the various lighthouse districts by the general inspector, examiner, and officers of the Bureau, was continued with good results. It is understood that similar methods in other services of the Department have been arranged or contemplated.

The standard method of cost keeping was continued during the fiscal year, and a general summary of results is given under a separate head. It is also understood that this method has served as a pattern for other bureaus and services.

Arrangements were made for supplying the district offices with window envelopes, for use when appropriate, with a view to reducing clerical work and preventing errors in mailing.

Instructions were issued the inspectors in reference to the exchange of blueprints of new devices, methods, etc., among the various district offices, in order that all offices may be kept promptly informed of any desirable improvements or apparatus.

Instructions in reference to the more general use of mileage books for employees when traveling on official business were issued for guidance whenever economy might be thereby secured.

A standard form of letter giving information to prospective applicants for lighthouse keepers and other noneducational positions in the Service was prepared and distributed among the inspectors, for use in answering inquiries on the subject.

In order to facilitate assignment of employees from one lighthouse tender to another, as the interests of the Service require, the Department authorized the regarding of all appointive positions on tenders as in the Lighthouse Service at large, instead of on the particular vessel, as was formerly the case. This will greatly lessen the number of papers required to be prepared when vessels are transferred from one district to another.

With a view to preliminary training for light keepers prior to their permanent assignment to light stations, arrangements have been made, with the approval of the Department, for the appointment of a few additional keepers for a trial system of general training and instruction for such employees in selected districts.

The custom of issuing lists of spare property available for transfer in all lighthouse districts was continued, with good results.

To comply with the rules of the Interstate Commerce Commission and at the same time obtain the advantage of lower freight rates on empty gas tanks, suitable instructions and labels for the shipping of gas tanks, whether charged or empty, were issued during the year.

Instructions were also given in reference to ordering the smallest size freight cars which will properly accommodate the articles to be shipped, in order to obtain the most economical rates for the Lighthouse Service.

Rules for the preparation of commendatory letters, for the Secretary's signature, in the case of employees performing some signal act in saving life or property, were issued by the Department during the year.

The publication of the monthly Lighthouse Service Bulletin was continued throughout the year, with beneficial results.

The exhibit of the Lighthouse Service at the Panama-Pacific International Exposition at San Francisco was installed, and a brief description of its purpose and nature will be found under a separate head.

COST-KEEPING SYSTEM AND RESULTS.

A standard method of cost keeping has been continued in effect throughout the fiscal year, and reports have been received from all the districts, in which itemized costs of each office, depot, light and fog signal station, tender, and light vessel are shown separately. The costs of minor lights, daymarks, and lighted and unlighted buoys are shown in groups by various districts, each type of aid to navigation being accounted for separately. In all cases the costs are divided into main headings—maintenance and betterments. The cost of maintenance includes what may be considered fixed charges, such as salaries, rations, fuel, and general expendable supplies. The item of betterments includes repairs, improvements, and new construction, and is further subdivided to show the cost of labor and materials separately for each principal object.

The costs are based on the actual expenditures during the fiscal year, whether of money or supplies. They are checked with the money accounts by taking into consideration the actual cash expenditures and the difference in the value of supplies on hand at the beginning and at the end of the year. The information from this cost-keeping system is useful in preparing estimates, planning work, effecting economies, and comparing the efficiency of different districts, vessels, light stations, apparatus, methods, etc.

A generalized summary of costs for the fiscal year ended June 30, 1915, follows, as derived from this cost-keeping system. Overhead charges, offices, depots, and tender service are stated as separate features in this summary and are not distributed nor included in the costs of aids to navigation.

SUMMARY OF COSTS, LIGHTHOUSE SERVICE, FISCAL YEAR ENDED JUNE 30, 1915.

[Amounts are stated to nearest even dollar, causing occasional minor discrepancies in totals. Difference from total expenditures reported elsewhere is due to inclusion of Bureau salaries, printing expenses, and adjustment of inventories of articles already in stock.]

TOTAL COSTS OF PRINCIPAL FEATURES.

Feature.	Maintenance expenses.				Betterment expenses.				Grand total.	Per cent.	
	Salaries.	Subsistence.	General supplies.	Incidental expenses.	Total.	Repairs and improvements.		New works.			Total.
						Labor.	Materials and supplies.				
Administration ^a	\$334,535		\$53,760	\$2,549	\$390,844				\$390,844	7	
Distributive charges ^b	816,400	\$201,879	436,455	33,068	1,487,802	\$117,758	\$117,879	\$138,445	1,861,884	34	
Aids to navigation ^c	1,482,894	251,491	381,732	22,808	2,138,901	249,048	484,656	422,671	3,295,300	59	
Total.....	2,633,829	453,370	871,947	58,425	4,017,547	366,806	602,535	561,116	5,548,028	100	

TOTAL COSTS OF DETAILED FEATURES.

Offices	\$334,535		\$84,373	\$2,549	\$421,457			\$421,457	8
Depots	165,097		64,039	22,005	251,141			402,894	8
Tenders:									
Large	179,770	\$53,178	107,864	2,138	342,950	19,412	19,413	39,478	7
Medium	415,077	130,098	205,103	7,799	758,077	52,155	52,156	168,626	16
Small	56,456	18,603	28,836	1,126	105,018	7,112	7,113	14,225	2
Total	651,303	201,879	341,803	11,063	1,206,045	78,679	78,682	222,329	25
Light vessels:									
Exposed	161,052	38,823	42,573	1,985	244,433	36,935	36,936	73,871	6
Moderately exposed	93,927	25,801	20,653	218	140,662	39,736	39,737	90,959	4
Relief	59,113	14,813	17,596	461	91,978	7,500	7,501	15,210	2
Lakes	38,094	11,064	7,564	989	57,711	6,233	6,234	51,226	2
Total	352,186	90,501	88,386	3,653	534,784	90,404	90,408	221,206	14

Light stations:	115,256	20,751	30,220	1,328	167,553	17,536	20,958	1,587	40,081	207,634	4
	46,337	8,426	16,480	187	71,425	6,964	10,506	3,361	20,851	92,276	2
	94,790	19,835	36,491	1,295	152,411	22,307	20,438	41,704	84,439	236,860	4
	21,212	4,085	5,077	78	30,449	7,098	5,223	114,376	12,427	42,876	1
	324,682	64,197	91,199	2,657	482,730	47,135	56,572	114,376	218,083	700,813	12
	602,277	117,294	179,467	5,545	904,568	101,060	113,697	161,134	375,891	1,280,459	23
	90,924	18,687	18,162	101	127,869	6,335	7,537	87	13,959	141,828	3
	49,037	9,143	8,160	183	66,522	4,115	10,214	368	14,697	81,219	1
	72,003	8,088	12,806	165	93,064	7,358	4,285	13,948	25,593	118,657	2
Minor fixed aids:	220,913		17,064	1,021	238,999	2,804	6,785	4,464	14,053	253,052	5
	92,842	7,718	35,892	4,373	140,821	23,583	55,350	142,273	221,206	362,027	6
			1,301	498	1,799	2,842	2,257	2,275	7,374	9,173	.....
	525,719	43,636	93,385	6,341	669,074	47,037	86,428	163,415	296,882	965,956	17
	2,712		19,252	2,383	24,347	2,364	121,800	57,668	181,832	206,179	4
			1,242	4,886	6,128	8,183	72,323	.....	80,506	86,634	1
Buoys:			20,494	7,269	30,475	10,547	194,123	57,668	262,338	292,813	5
	2,712										
	2,633,829	453,370	871,947	58,245	4,017,547	366,806	602,535	561,116	1,530,459	5,548,028	100

a Includes offices, except expenses of publications and general freight accounts.
b Includes depots and tenders; also items excepted above, charged to supplies.
c Includes light vessels, light stations, minor fixed aids, and buoys.

SUMMARY OF COSTS, LIGHTHOUSE SERVICE, FISCAL YEAR ENDED JUNE 30, 1915—Con.

AVERAGE COSTS OF SELECTED FEATURES.

Average cost of—	Salaries.	Subsistence.	Illuminants.	Fuel.	Other supplies.	Incidentals.	Total maintenance.	Repairs and improvements.	Total.
District office, exclusive of third.....	\$12,252				\$2,025	\$131	\$14,408		\$14,408
District depot, exclusive of third.....	6,831				2,024	922	10,377	\$4,616	14,993
Large tender, Pacific.....	22,612	\$5,945		\$9,724	4,055	286	42,622	5,458	48,087
Large tender, Atlantic.....	18,655	5,800		8,025	3,063	213	35,846	3,740	39,587
Medium tender.....	14,740	4,604		4,865	2,399	277	26,885	3,721	30,606
Exposed light vessel.....	8,053	1,941	\$77	1,197	854	99	12,221	3,693	15,914
Moderately exposed light vessel.....	4,473	1,231	82	280	622	10	6,698	3,784	10,482
Lake light vessel.....	3,323	950	105	300	292	22	4,992	1,218	6,210
First-order light stations with powerful fog signals...	2,465	430	135	277	248	23	3,578	1,032	4,610
First-order light stations without fog signals.....	1,800	330	147	110	208	24	2,619	515	3,134
Fourth-order light stations with powerful fog signal...	1,430	287	65	272	195	17	2,226	632	2,898
Fourth-order light stations without fog signal.....	658	131	34	44	90	6	974	295	1,269
Lens lantern.....	189	21	18	5	11		245	a 31	276
Minor light, river districts...	90		2		3		95	a 1	96
Minor light, other districts...	121		11		5	1	138	a 14	152
High-pressure acetylene light.....	36	3	30	2	8	4	83	a 157	240
High-pressure acetylene buoy.....			36		b 51	1	88	a 15	c 103
Low-pressure acetylene buoy.....			130		b 22		152	a 22	c 174
Oil-gas buoy.....			32		b 21	1	54	a 7	c 61

a Figures do not include cost of establishment of new aids.

b Figures include transportation charges of all kinds, such as freight on new buoys, etc.

c Figures do not include renewal of appendages.

ENGINEERING AND CONSTRUCTION.

New works of principal importance under special appropriations completed during the fiscal year are as follows: Cape Cod Canal entrance lights, Mass.; Rondout (North Dike), N. Y., light and fog signal; Miah Maull Shoal, N. J., light and fog signal; Brandywine Shoal, Del., light and fog signal; Thimble Shoal, Va., light and fog signal; Cape Fear River lights, below Wilmington, N. C.; Oconto Harbor light, Wis.; Point Arena, Cal., improvement of road.

Other important work in progress at the close of the fiscal year includes Atchafalaya Entrance Channel, La., aids to navigation; Galveston Jetty, Tex., light station; Navassa Island, West Indies, light station; Ashtabula, Lorain, and Cleveland, Ohio, light stations; Ashland, Wis., light and fog signal; Manistique, Mich., light and fog signal, and Cape St. Elias, Alaska, light and fog signal.

Extensive study has been given to the protection of exposed shores of various lighthouse reservations from erosion by the sea, and good results have been obtained in a number of instances, by the judicious location of bulkheads, sea walls, or groins.

A study was also made of the effects of sea water on concrete piles in lighthouse works on the south Atlantic and Gulf coasts, indicating that where a fairly rich mixture is used and the reinforcing rods are set back a proper distance from the outside surface of the pile, and precautions have been observed in manufacturing and curing the piles, the effect of sea water, so far as has been observed, is negligible.

A new type of single pile pipe beacon, carrying a latticed cage day-mark, was developed and several placed in service at a moderate cost.

Careful attention has been given in the matter of designing, to develop permanent and fireproof structures in all cases where available funds will permit.

IMPROVEMENT OF APPARATUS AND EQUIPMENT.

A complete line of oil-engine torches, as described in the report for 1914, has been designed, so as to be suitable for any size or type of oil engine in the Service.

Service tests have been made of spar buoys made from logs cut on lighthouse reservations on the Great Lakes. The quality of the timber is good and a considerable saving in cost has also been effected.

Improvements have been made in connection with electric sirens to avoid the rising and falling notes and the wearing of the bearings due to continued starting and stopping of the mechanism.

Experimental installations were made of temporary unwatched gas lights for winter use at certain isolated stations on the Great Lakes, permitting the keepers to leave under safer conditions and at the same time giving service to belated mariners after the close of the regular navigation season. Three such installations were in commission in Lake Michigan last winter and gave good results. Consideration will be given to extending this arrangement to other important offshore Lake stations.

A test of a new method of signaling under water by means of a patented device known as an oscillator was made at a light vessel during the year. Further experiments were also conducted along the lines of radio fog signals.

Radio apparatus was ordered for five lighthouse tenders. The equipment was designed and manufactured by the Bureau of Standards, with special reference to the particular duties required by the Lighthouse Service.

A new type of electric flasher for gas lights was developed and placed in service. This device is operated by means of dry cells, which control magnets opening and closing the gas valve, as contacts are made by detachable cams on a master clock. Any desired characteristic may be obtained by the attachment of properly arranged cams.

In order to facilitate the landing of supplies and mail at certain isolated Alaska stations, line-throwing guns, similar to those in use by the Coast Guard, have been installed as part of the station equipment. Experiments are also in progress with reference to the use of this device on board lighthouse tenders, for passing lines to other vessels in heavy weather.

An automatic gas-tank manifold, the object of which is to exhaust the gas successively from tanks arranged in batteries, has been experimentally developed. Except for the difficulty of making all connections perfectly gas-tight, the advantage of this arrangement is very material, since only the tanks which have become entirely exhausted require replacing.

A fog-signal installation, with sirens 900 feet distant from the compressors, has been in successful operation. The blasts are given by pneumatic valves controlled by solenoids, which in turn are ener-

gized by a battery and the time intervals regulated by a timing device in the power house. The entire installation is in duplicate, and so arranged that either siren may be operated at will by means of switches at the power house.

A two-tank cast-iron breakwater light has been designed, with the object of supporting the lantern and tanks at such heights that waves breaking over the breakwater will have relatively slight effect upon the structure.

In cases where old fog signals have been found deficient in power or distribution of sound, measures have been taken to install duplicate first-class automatic air sirens with double-mouth horns. In other cases of revolving lights, where old wheel chariots have worn out in service, measures to replace them by ball-bearing chariots have been taken.

Service tests have been made of new brands of red paint, particularly in localities where the action of the elements has been found severe, owing to unfavorable conditions of heat and moisture. These tests have been successful and such paints, although higher in cost, give the aids so painted a very conspicuous and bright appearance.

With a view to standardizing the sizes of burners in gas apparatus, various standard combinations of different capacity burners for corresponding diameters of lenses were determined.

A standard 300-pound wrought-iron grapnel anchor, suitable for recovering chain and other articles from overboard, was developed at the general depot.

A study was made of the most practicable method of keeping a card record showing the bearings, local ranges, and other information for service use in accurately locating the positions of buoys and light vessels.

A sound deflector has been installed behind a powerful fog signal at the entrance to the harbor of an important city, and has been found effective in lessening the annoyance of the fog signal to residents.

APPROPRIATIONS AND EXPENDITURES.

The appropriations for the maintenance of the Lighthouse Service for the fiscal year 1916 were \$5,164,030, being \$12,400 in excess of those for the preceding fiscal year. The estimates for maintenance appropriations for 1916 were divided into one appropriation for general expenses of supplies, repairs, etc., and three appropriations for salaries, with an alternative providing for all maintenance appropriations in a single item. This alternative proposition was not authorized by Congress. It is believed, however, that with this form of appropriation a more economical and efficient administration of the Lighthouse Service could be effected, and in the estimates for the next fiscal year attention has been drawn to the fact that if this consolidation is authorized a reduction of \$25,000 in the total estimates may be safely made. The appropriations for special works made for the fiscal year 1916 amounted to \$250,000. The average appropriations for special works for the ten preceding years, 1906 to 1915, inclusive, amounted to \$877,884.

The detailed estimates for the fiscal year 1917 are given on page 73. The total amount for general maintenance is \$177,800 more than the appropriation for the present year. The estimate for the Bureau

of Lighthouses in Washington is \$3,200 more than the appropriation for the preceding year. Estimates for 36 special works have been submitted, aggregating \$2,002,300, considering only groups 1 and 2. This is \$1,752,300 more than the appropriation for special works for the preceding year, and includes a number of important works for which estimates were submitted last year, but which were not included in the appropriations. The estimates include two new lighthouse tenders, two new light vessels, nine new light and fog-signal stations, three new light stations, three new lighthouse depots, six items for establishing or improving aids in general localities, one item for a new system of harbor or channel lights and other aids, six items for improvements of light or fog-signal stations or of groups of aids to navigation, three items for improvement of lighthouse depots, and one item for light keepers' dwellings.

In selecting and submitting estimates for those special works believed to be most important, there were considered estimates submitted by officers in the various districts for new lighthouse and ship construction aggregating about \$5,030,000. Many items not included in the estimates for this year are thought to be meritorious, and the more important of them are included in group 3 of the estimates for special works, submitted for consideration as the resources of the Government permit them to be taken up. Explanation of the necessity for each of the items of special works is included with the estimates.

The tables following give comparisons of appropriations and expenditures for the Lighthouse Service, beginning with the fiscal year 1912 and including the estimates for 1917.

APPROPRIATIONS, LIGHTHOUSE SERVICE, FISCAL YEARS 1912-1916, WITH ESTIMATES FOR 1917.

[The salaries and allowances of officers of the Navy and Army on duty with the Lighthouse Service are not included in this table.]

Item.	Appropriations.					Esti- mates, 1917.
	1912	1913	1914	1915	1916	
MAINTENANCE.						
Salaries, Bureau of Lighthouses.....	\$64,630	\$64,630	\$64,510	\$64,030	\$64,030	\$67,230
Salaries of keepers of lighthouses.....	930,000	930,000	930,000	940,000	940,000	940,000
General expenses, Lighthouse Service.....	2,569,400	2,609,400	2,750,000	2,775,000	2,775,000	2,840,000
Salaries, lighthouse vessels.....	1,007,420	957,420	967,420	997,000	1,010,000	1,100,000
Salaries, Lighthouse Service.....	465,960	475,960	360,000	375,000	375,000	394,600
Total for maintenance.....	5,037,410	5,037,410	5,071,930	5,151,630	5,164,030	5,341,830
Unexpended balances (obligations estimated).....	125,400	73,742	50,734	53,424		
SPECIAL WORKS.						
New light and fog-signal stations.....	700,950	69,000	432,500	63,000		638,500
Light vessels.....	75,000	380,000	125,000			280,000
Lighthouse tenders.....	7,000				250,000	170,000
Keepers' dwellings.....						83,000
Improvement of aids.....	110,000	77,500	22,000	50,000		526,800
Lighthouse depots.....	100,000		125,000	23,000		304,000
Total for special works.....	992,950	526,500	722,600	136,000	250,000	2,002,300
Total maintenance and special works.....	6,030,360	5,563,910	5,794,530	5,287,630	5,414,030	7,344,130

EXPENDITURES FROM APPROPRIATIONS, LIGHTHOUSE SERVICE, FISCAL YEARS
1911-1915.

[Actual expenditures, regardless of year of appropriation.]

Expenditures.	1911	1912	1913	1914	1915
For maintenance.....	\$5,046,063	\$5,058,049	\$5,037,778	\$5,166,609	\$5,111,121
For special works.....	414,296	310,885	461,627	538,338	500,516
Total.....	5,460,359	5,368,934	5,499,405	5,704,947	5,611,637

DEPOTS.

The Lighthouse Service maintains 44 depots in the various districts for the storage and distribution of supplies and for other purposes.

The act of August 1, 1914, contained an appropriation of \$23,000 for a new carpenter shop at the general lighthouse depot, Tompkinsville, N. Y., to replace the present frame structure, which is a grave menace in case of fire. Plans for the new structure were prepared and the work advertised, a contract being awarded subsequent to the close of the fiscal year.

Plans for the new lighthouse depot at Charleston, S. C., for which an appropriation was made by the act of October 22, 1913, were prepared, and, after correspondence with the War Department relative to a desired modification of the pierhead line, the necessary permit was obtained and a contract let for the construction of the wharf after the close of the fiscal year.

In the following districts provision should be made for improved depot facilities:

In the second district the present depot at Lovells Island, Boston Harbor, is for a number of reasons unsatisfactory, and Congress has authorized the transfer for this purpose of the old marine-hospital site at Chelsea, Boston. This property is now under lease to private parties. The question of obtaining possession of this or some other suitable site is under consideration, and an estimate is submitted for the construction of this depot.

The depot at Woods Hole, Mass., also in the second district, although well located for the work of the Service in the vicinity, is not as useful as it should be, on account of shallow water around the dock and approaches. Estimates are submitted for dredging the channel and basin around the wharf and for the erection of a brick storehouse to replace the present wooden one. This work was authorized by the act of March 3, 1915, but appropriation has not yet been made.

In the third district estimates are submitted for improvement to the offices and laboratory at the Staten Island Depot.

In the fifth district the present principal depot at Portsmouth, Va., is inadequate both in area and in water front, considering the size of the district and the number of lighthouse vessels to be accommodated. Estimate is submitted, to be considered when resources permit, for enlarging this depot or establishing a new one.

In the eleventh district estimates are submitted for repairs and improvements at the depot at Detroit, Mich.

The present depot at Milwaukee, Wis., is practically surrounded by coal yards and the coal dust is objectionable. Consideration is being given to obtaining a more suitable site.

In the sixteenth district, which in 1910 was organized as a separate lighthouse district, no permanent arrangement has yet been made for a depot, but temporary space is being rented at Ketchikan. An estimate has been submitted, to be considered by Congress as resources permit, for the purchase of a site and the necessary equipment for a lighthouse depot in Alaska.

In the eighteenth district estimates are submitted, for consideration as resources permit, for repairs and improvements to the Goat Island Depot, Cal.

In the nineteenth district the headquarters of the Lighthouse Service are at Honolulu, and storage facilities are either rented or granted by the courtesy of other branches of the Government. The establishment of a permanent depot in this district would facilitate the work of the Service, and estimates are submitted for that purpose, as well as for making temporary provision pending the establishment of a permanent depot.

LIGHTHOUSE TENDERS.

The tenders of the Service have been employed to good advantage during the year. The 46 vessels which have been in commission have steamed a total of about 469,000 nautical miles in their work of supplying light stations, maintaining the buoyage system, transporting construction materials, and carrying the officers and employees of the Service to their stations or on inspection duty.

Contract was awarded May 4, 1915, for the construction of the first-class seagoing lighthouse tender *Cedar*, for service in Alaska. The contract calls for completion in May, 1916.

The medium-draft tender *Laurel*, for service in the fifth lighthouse district, was completed during the fiscal year and went into commission May 21, 1915.

The small tender *Fern*, for service in the inside waters of the sixteenth lighthouse district, was launched on February 6, 1915, and completed during the fiscal year, proceeding to her station of duty on July 1, 1915.

Contract was awarded on November 6, 1914, for the medium-draft tender *Rose*, for service in the bays and sounds of the seventeenth lighthouse district. Work on the vessel was in progress at the close of the fiscal year.

The use of oil fuel is provided for the new tenders for the Pacific coast.

Authority has been granted extending the use of the appropriation of \$200,000 heretofore made for the construction of two tenders, for the construction of two or more tenders for general service, it being thought that additional small tenders may be constructed out of this appropriation.

A light-draft tender and barge has been authorized for use in establishing and maintaining aids along the intercoastal waterways of Texas and Louisiana, but no appropriation for the purpose has as yet been made.

With the increase in the number of aids to navigation and the deterioration of older vessels it will probably be necessary to construct on an average one or two new tenders each year.

Plans are in preparation for the construction of light vessels *No. 99* and *No. 100*.

On account of the deterioration of older vessels it will be necessary to construct one or more new light vessels each year.

Estimate is submitted for new light vessels for general service on the Great Lakes, where they are much needed to replace vessels which must soon be withdrawn from duty.

The work of raising Buffalo Light Vessel *No. 82*, referred to in the report for 1914, was completed after the close of the fiscal year. The original contractor abandoned the work, which was subsequently relet to another contractor, who recovered the vessel successfully on September 17, 1915.

Careful attention has been paid in designing and remodeling light vessels to making all parts of such vessels accessible for cleaning and painting; the use of internal-combustion engines has also been extended, which it is believed will effect an economy in maintenance.

The following light vessels have either been extensively overhauled or such work has been started during the last fiscal year: *No. 34*, Charleston, S. C.; *No. 52*, Fenwick Island Shoal, Del.; *No. 54*, Boston, Mass.; *No. 67*, Umatilla Reef, Wash.; *No. 76*, relief (eighteenth district); *No. 80*, Cape Lookout Shoals, N. C.; *No. 91*, Winter-Quarter Shoals, Va.

It is probable that during the current fiscal year extensive overhaul will be completed or undertaken on the following light vessels: *No. 2*, relief (fifth district); *No. 6*, relief (second district); *No. 49*, Cape Charles, Va.; *No. 55*, Lansing Shoal, Mich.; *No. 56*, North Manitou Shoal, Mich.; *No. 57*, Grays Reef, Mich.; *No. 60*, Eleven-Foot Shoal, Mich.; *No. 81*, Heald Bank, Tex.

The following was the total number of light vessels and stations on June 30 of the years named:

Year.	Light vessels.	Light-vessel stations.
1910.....	68	54
1911.....	63	51
1912.....	65	51
1913.....	67	53
1914.....	66	52
1915.....	66	53

Of the present light vessels 35 have self-propelling machinery and 29 are provided only with sail power. Two have no means of propulsion.

On June 30, 1915, the following was the status of the light vessels: Regular vessels on station, 49; relief vessels on station, 4; relief vessels at depots, 2; regular vessels under repair, 4; relief vessels under repair, 6; relief vessels laid up, 1.

COOPERATION.

In accordance with the established custom of the Service, every effort has been continued to consult the needs of maritime interests and to cooperate effectively with other branches of the Government in matters relating to the work of the Lighthouse Service.

Through cooperation with the passenger steamer lines on Long Island Sound, Conn. and N. Y., regulation of steamer traffic was secured by establishing east-bound and west-bound lanes of travel, the Service providing a special gas and whistling buoy, also a bell buoy, to assist in this work. These arrangements were put into effect during the fall of 1914, and in the opinion of navigators have been satisfactory in reducing the possibility of collision in the vicinity, particularly during fog.

Assistance was given other bureaus of the Department in the design of vessels. A temporary drafting room in the Bureau's office was occupied by Coast Survey officers in charge of such work for that service, with officers of the Lighthouse Service acting in a consulting capacity. At the close of the fiscal year general assistance along the same lines was being extended to the Bureau of Fisheries.

Arrangements have also been made for the repair of vessels belonging to other services of the Department at the general depot, when such work can be conveniently done and other duties at the depot will permit.

Conference was had with the Canadian Department of Marine and Fisheries, with the result that that department is taking measures for the establishment of a light and fog signal at Point Abino, north side of Lake Erie. This will prove a valuable aid to navigation on the Great Lakes.

By Executive order of the President three lighthouse reservations in waters adjacent to Puget Sound, Wash., were set apart as refuges for native birds, under the supervision of the Department of Agriculture.

Under the authority granted by the act of March 3, 1915, arrangements were made with the Forest Service for the reforestation of certain lighthouse reservations on the Great Lakes, where conditions are favorable for the growth of timber, to be used by the Lighthouse Service for spar buoys and other purposes.

Arrangements were made with the Public Health Service for the care and treatment of employees of the Lighthouse Service at marine hospitals and relief stations, upon the same terms as exist for the Army and Navy, under suitable regulations. Arrangements for the vaccination against typhoid fever and smallpox of employees of the Lighthouse Service were also made with the Public Health Service.

Sanitary inspections of various stations and vessels were made by officers of the Public Health Service during the year. While the general sanitary conditions were found to be excellent, valuable suggestions as to improving minor conditions were received.

Cooperation with the United States Engineer officers in charge of river improvements in the river districts has been continued with success. As a result of this work, in the thirteenth and fourteenth districts, a test is being made of caring for the aids by vessels of the Engineer Department.

Arrangements were made to supply the Hydrographic Office of the Navy Department with information relative to drifting buoys recovered in the open sea, for use in the study of currents.

Toward the close of the fiscal year arrangements were being made with the Coast and Geodetic Survey for a supply of charts to be available for sale on selected lighthouse tenders.

At the request of the Coast and Geodetic Survey, arrangements were made for taking certain slack-water observations and current measurements in the general vicinity of the eastern entrance to Long Island Sound, R. I., Conn., and N. Y.

Cooperation was had during the year with practically all maritime branches of the Government, particularly the Navy Department, in the prompt reporting of all information affecting aids to navigation.

SAVING OF LIFE AND PROPERTY.

During the fiscal year 1915 services in saving of life and property were rendered and acts of heroism performed by employees of the Lighthouse Service on vessels or at stations on 143 occasions, a list of which is given on page 60.

REPORT OF OPEN-MARKET PURCHASES.

In compliance with the act of June 17, 1910, there is submitted separately as a part of this report a list of purchases of materials and supplies for the Lighthouse Service made without obtaining bids under public advertisement, with the reasons for so purchasing.

EXHIBIT AT PANAMA-PACIFIC INTERNATIONAL EXPOSITION.

The Lighthouse Service was allotted approximately 3,300 square feet of space in the north end of the Machinery Building, and the sum of \$4,750 from the appropriation for the Government's exhibit as a whole. It was planned to make the exhibit of interest from both a historical and practical point of view.

The historic features included a collection of water colors, painted in 1859, of early light stations on the Pacific; the old 10-pounder cannon used from 1855 to 1857 at Point Bonita, Cal., being the first fog signal on the Pacific coast; the first Fresnel lens imported into this country in 1841 for use at Navesink, N. J., as well as the first lens used on the Pacific coast at Alcatraz, Cal., in 1854; also a collection of old lamps used for burning sperm oil, lard oil, and early plunger and air pressure lamps for kerosene.

From a practical standpoint, the exhibit included 50 enlarged photographs of important lighthouse objects, with models to scale of a number of important light stations and vessels.

A modern flashing lens and lantern, also improved forms of fog-bell strikers and a recent type of compressed-air fog signal, using a 6-inch siren, were shown. Present practice in lamps was illustrated by incandescent-oil-vapor outfits of 35 and 55 millimeter mantles, along with smaller sizes of lens and post lanterns. Typical sizes and types of buoys, such as whistling, bell, cans, and nuns, with ballast balls, sinkers, and anchors were also shown.

The attendants on duty were experienced lighthouse keepers, selected from the Pacific coast districts for details of about three weeks each, and were present in uniform to care for and explain the apparatus.

A medal of honor was awarded the exhibit by the exposition authorities, and silver medals were awarded to those officers who collaborated in the preparation of the exhibit.

LEGISLATION ENACTED AFFECTING THE LIGHTHOUSE SERVICE.

The following is a summary of special legislation affecting the Lighthouse Service enacted at the second and third sessions of the Sixty-third Congress during the fiscal year 1915.

The following appropriations were made by the act of August 1, 1914: Carpenter shop for the general lighthouse depot, Tompkinsville, N. Y., \$23,000; completion of Kilauea Point Light Station, Kauai Island, Hawaii, \$3,000; aids to navigation in Alaska, \$60,000; and aids to navigation at the entrances to the Cape Cod Canal, Mass., \$50,000.

The act of August 22, 1914, authorized the transfer from the Interior Department of approximately 206 acres of land on the Quinaialet Indian Reservation, near Cape Elizabeth, Wash., to the Department of Commerce for lighthouse purposes, under suitable restrictions in reference to the tribal rights.

The act of January 25, 1915, appropriated \$250,000 for a lighthouse tender for general service. This vessel has been named *Cedar*, and will be assigned to duty in Alaska.

The act of March 3, 1915, granted authority for the following purposes:

The use of the unexpended balance of the appropriation of \$200,000 heretofore made for two tenders for general service, for the construction of additional tenders for general service.

The transfer of a portion of the Tawas lighthouse reservation, Mich., to the Secretary of the Treasury for purposes of the Coast Guard.

The establishment and maintenance, in the discretion of the Commissioner of Lighthouses, of post-lantern lights and other aids to navigation on Lakes Okechobee and Hicpochee and connecting waterways across the State of Florida and on the Apalachicola River and Chipola cut-off.

Leave of absence for per diem employees who have served 12 consecutive months, under rules prescribed by the Secretary of Commerce.

Cooperation between the Lighthouse Service and the Forest Service in the management of forest land on lighthouse reservations.

Authorizing chief clerks in offices of lighthouse inspectors and persons designated by them to administer oaths to travel accounts or other expenses against the United States, and to administer oaths of office to employees of the Lighthouse Service.

The penalties provided by law for obstruction to or interference with any aid to navigation maintained by the Lighthouse Service are made applicable with equal force and effect to any private aid to navigation lawfully maintained under the private-aids act.

The act of February 17, 1915, appropriated \$5,556.70 to reimburse the Southern Transportation Co. for damages to their barge *Antietam*, which was in collision on February 4, 1913, with light vessel No. 80 in Baltimore Harbor, Md.

The act of March 3, 1915, appropriated \$331.70 to reimburse Epps Danley for property lost by him while light keeper at East Pascagoula River Light Station, Miss., during a storm in 1906.

The act of March 4, 1915, appropriated \$1,091.41 for the payment of seven claims for damages occasioned by collisions for which vessels of the Lighthouse Service were found to be responsible.

The following works were authorized by the act of March 3, 1915, at the limits of cost specified, but no appropriation of funds was made: Light at Dog Island, Me., \$3,500; improvements at Woods Hole depot, Mass., \$50,000; improving aids, Hudson River, N. Y., \$100,000; improving aids, Sandy Hook, N. J., \$20,000; improving aids, Delaware River, Pa. and Del., \$80,000; improving aids, St. Johns River, below Jacksonville, Fla., \$66,000; additional aids, Florida Reefs, Fla., \$75,000; improving aids, Mississippi River, below New Orleans, La., \$50,000; small tender and barge, eighth district, Texas and Louisiana, \$20,000; light and fog signal, Conneaut, Ohio, \$63,500; improving aids, Toledo Harbor, Ohio, \$15,000; improving aids, Fighting Island Channel, Detroit River, Mich., \$25,000; light and fog signal, Kellett Bluff, Henry Island, Wash., \$40,000; improving aids, entrance to Coquille River, Oreg., \$6,000; light and fog signal, Point Vicente, Cal.; \$80,000; aids to navigation, Pearl Harbor, Hawaii, \$80,000.

SPECIAL LEGISLATION NEEDED.

The following additional legislation for the Lighthouse Service is considered desirable:

The salaries of lighthouse inspectors are, by the act of June 17, 1910, limited to \$2,400 a year, except the inspector of the third district, whose salary is fixed at \$3,600. The salary of \$2,400 is inadequate because of the heavy responsibilities with which the inspector is charged and the technical and business ability required to successfully discharge the duties. The compensation of these positions should be sufficient to bring into and retain in the Lighthouse Service a class of persons fully competent to efficiently conduct such important work. The inspectors should be men of high character and qualifications, including technical knowledge as to engineering and nautical affairs, and should have business ability. It is recommended that the salary of inspectors, except the third, be increased to not to exceed \$3,000 a year.

Authority is also requested that the Secretary of Commerce be empowered to exchange rights of way in connection with lighthouse reservations. This is considered desirable for the best interests of the Service, as in many cases the existing rights of way over land leading to lighthouse reservations may, with the authority requested, be exchanged for others, more direct and suitable in character.

Recommendation is made that authority be granted to establish and maintain post-lantern lights and other aids to navigation, out of the annual appropriations for the Lighthouse Service on the Mobile, Tombigbee, Warrior, and Black Warrior rivers, Ala. The lighting of rivers or inland waters is limited to those specifically authorized by Congress, and such authority has not been granted for the waters specified. These rivers have been extensively improved by the building of locks under the War Department, and an increasing commerce, principally of barges carrying coal, has been developed. Maritime interests in these localities have urged the establishment of aids and investigation by the Lighthouse Service has shown that such action is warranted.

Authority is also requested for making the appropriation, "General expenses, Lighthouse Service," available for the purchase, equipment,

repair, and operation of motor-propelled vehicles for carrying passengers or freight in the Hawaiian Islands. On account of the prohibition contained in the act of August 1, 1914 (38 Stat., 508), there is no appropriation available for this purpose. Except in the vicinity of Honolulu, travel in those islands is almost exclusively by automobile, and on account of the long distances the expense is very high. It is desired to purchase a motor cycle for the use of foremen and other employees in connection with construction and repair work of the Service, which will effect a material saving in transportation expense and in the time of the employees.

Authority is requested also for extending the benefits of the Public Health Service to lighthouse keepers and assistant lighthouse keepers. The employees in question are mostly employed at isolated places and in many cases their compensation is such as to make it a hardship for them to bear the expense of illness or injury. There is already provision for the care and treatment by the Public Health Service of officers and crews of vessels of the Lighthouse Service, without charge, and it is considered just that the other employees named herein be given the same benefits. The proposed legislation has the approval of the Secretary of the Treasury.

There is great need for provision by law for the retirement of employees of the Lighthouse Service who after long service have lost their ability for active duty by reason of age or disability incident to their work. This is essential to full efficiency in the administration of the Service. In the report for 1912 a statement was given showing the practice in a number of important foreign countries with reference to the pensioning of employees in the respective lighthouse services in common with other civil employees in those countries, from which it appears that a retirement system is in force with favorable results under all of the other governments mentioned.

The statistics as to the various classes of aids to navigation and fuller details on many of the subjects mentioned in this report will be found in the pages following.

Respectfully,

GEORGE R. PUTNAM,
Commissioner of Lighthouses.

To Hon. WILLIAM C. REDFIELD,
Secretary of Commerce.

naval commandants under allotments made from the appropriations for the Lighthouse Service. The Lighthouse Service also has supervision over the establishment and maintenance of private aids to navigation and the lighting of bridges over navigable waters of the United States.

At the present time the United States assists in the maintenance of but one lighthouse outside of its territory, this being at Cape Spartel, Morocco. This light is maintained in accordance with the convention between Morocco and the United States, Austria, Belgium, Spain, France, Great Britain, Italy, Netherlands, Portugal, and Sweden, in force since March 12, 1867. The lighthouse was constructed at the expense of Morocco, but it is maintained by the other contracting powers. The annual appropriation by the United States for this purpose is \$325, and it is not under the control of the Lighthouse Service.

The jurisdiction of the Lighthouse Service over rivers not included in tidewater navigation is restricted to such as are specifically named in the various acts of Congress. These now include practically all the important navigable rivers and lakes of the country.

The following table shows the coast line of the United States and Territories under the jurisdiction of the United States, that designated general coast line being measured by steps of 30 miles, and that designated detailed coast line by steps of 3 miles; there are also given the lengths of the coastal and interior rivers and tributaries so far as they are lighted.

	General coast line.	Detailed coast or channel line.
	<i>Statute miles.</i>	<i>Statute miles.</i>
Atlantic and Gulf coasts of the United States.....	3,480	9,732
Pacific coast of the United States.....	1,404	3,294
Porto Rico, adjacent United States islands, and Guantanamo.....	374	449
Great Lakes and connecting waters, United States portion.....	2,520	4,020
Alaska.....	7,300	22,654
Hawaiian Islands and Midway Islands.....	788	1,018
Guam.....	86	92
American Samoan Islands.....	76	91
Total coast line under United States Lighthouse Service.....	16,028	41,350
Coastal rivers on which aids to navigation are maintained by the United States Lighthouse Service (Atlantic and Gulf coasts, 1,374 miles; Pacific coast, 242 miles).....		1,616
Interior rivers on which aids to navigation are maintained by the United States Lighthouse Service (Mississippi River, 1,920 miles; Ohio River, 967 miles; Missouri River, 390 miles; other rivers, 949 miles).....		4,226
Total coast line and rivers under United States Lighthouse Service.....		47,192
Philippine Islands (lighted by Philippine Government).....	4,080	11,511
Panama Canal Zone (coast line only).....	17	40
Total seacoast line under the jurisdiction of the United States (not including Great Lakes and rivers).....	17,605	48,881

LIMITS OF LIGHTHOUSE DISTRICTS.

First district.—From the head of navigation on the St. Croix River, Me., the north eastern boundary of the United States, to and including Hampton Harbor, N. H. It embraces all aids to navigation on the seacoast of Maine and New Hampshire, and on all tidal waters between the limits named.

Second district.—From Hampton Harbor, N. H., to Elisha Ledge, off Warren Point, R. I., but not including either the harbor or the ledge. It embraces all aids to navigation on the seacoast and tidal waters of Massachusetts, except on the Taunton River and that part of Mount Hope Bay lying within the State boundary.

Third district.—From Elisha Ledge, off Warren Point, R. I., to Cape May, on the coast of New Jersey, excepting Cape May Lighthouse, and to a point on the coast opposite Rehoboth, Del., excepting Cape Henlopen Lighthouse and Hen and Chickens Shoal. It embraces all aids to navigation on the coasts of Rhode Island, Connecticut, New York, and New Jersey northward of Cape May, including Northeast End, Five-Fathom Bank, and Overfalls light vessels, and McCries Shoal, and on all tidal waters tributary to the sea or Long Island Sound between the limits named, together with the aids on Whitehall Narrows, and on the United States waters of Lakes Champlain and Memphremagog.

Fourth district.—From and including Cape May Light Station, on the coast of New Jersey, to and including Fenwick Island Light Station on the coast of Delaware. It embraces all aids to navigation on the seacoast of New Jersey and Delaware between the points named, the entrance to Delaware Bay, Delaware Bay and River, and the waters tributary thereto, but does not include McCries Shoal, Overfalls Light Vessel, and the aids to navigation seaward thereof, nor the shoals seaward of Fenwick Island.

Fifth district.—From (but not including) Fenwick Island Light Station, on the coast of Delaware, to and including New River Inlet, N. C. It embraces all aids to navigation off the seacoast of Delaware seaward of Fenwick Island, on the seacoasts of Maryland, Virginia, and North Carolina, between the limits named, all of Chesapeake Bay, the sounds of North Carolina, and tributary waters.

Sixth district.—From (but does not include) New River Inlet, N. C., to and including Hillsboro Inlet Light Station, Fla. It embraces all aids to navigation on the seacoasts, bays, sounds, harbors, rivers, and other tidal waters of North Carolina, South Carolina, Georgia, and Florida between the limits named.

Seventh district.—From a point just south of Hillsboro Inlet Light Station to and including Cedar Keys, Fla. It embraces all aids to navigation on the sea and Gulf coasts of Florida, Florida Keys, and on other waters tributary to the sea and Gulf between the limits named.

Eighth district.—From (but not including) Cedar Keys, Fla., to the southern boundary of Texas. It embraces all aids to navigation on the Gulf coast of the United States and tidal waters tributary to the Gulf between the limits named, together with those on the Mississippi River below and including New Orleans, and on Grand Lake and Lake Chicot.

Ninth district.—The island of Porto Rico and the adjacent islands and other islands and stations ceded to the United States in the West Indies.

Tenth district.—From the mouth of the St. Regis River, St. Lawrence River, N. Y., to the mouth of the Detroit River. It embraces all aids to navigation on the United States shores and waters of Lakes Ontario and Erie and the upper part of the St. Lawrence River and the Niagara River, excepting aids to navigation at the mouth of the Detroit River.

Eleventh district.—From and including all aids to navigation at the mouth of the Detroit River, Mich., to the western end of Lake Superior. It embraces all aids to navigation on the United States shores and waters of Lakes St. Clair, Huron, and Superior, the Detroit River, including the mouth, the St. Clair and St. Marys rivers, and that part of the Straits of Mackinac lying to the eastward of a line drawn across the straits just to the eastward of Old Mackinac Point Light Station, Mich.

Twelfth district.—Includes all aids to navigation on Lake Michigan, Green Bay, and tributary waters lying west of a line drawn across the Straits of Mackinac just east of Old Mackinac Point Light Station, Mich.

Thirteenth district.—The Mississippi River from the head of navigation to the mouth of the Missouri River; the Minnesota River from the head of navigation to its mouth; the Illinois River from the head of navigation to its mouth; the Osage River from the head of navigation to its mouth; the Gasconade River from the head of navigation to its mouth; the Missouri River from the head of navigation to its mouth; St. Croix River and Lake; Lake Traverse; and includes all aids to navigation within these limits and navigable rivers tributary thereto.

Fourteenth district.—The Ohio River from Pittsburgh, Pa., to Cairo, Ill.; the Tennessee River from the head of navigation to its mouth; the Kanawha River from the head of navigation to its mouth; and embraces all aids to navigation within these limits and navigable rivers tributary thereto.

Fifteenth district.—The Mississippi River from and including the mouth of the Missouri River to New Orleans, La.; the Red River from the head of navigation to its mouth; and includes all aids to navigation within these limits and navigable rivers tributary thereto.

Sixteenth district.—From the boundary between Alaska and the Dominion of Canada to the boundary between Alaska and Siberia. It embraces all aids to navigation on the seacoast, bays, rivers, and other tidal waters of Alaska.

Seventeenth district.—From the boundary between California and Oregon to the northern boundary of the United States. It embraces all aids to navigation on the seacoast of Oregon and Washington, on the United States waters of the Strait of Juan de Fuca, Washington Sound, and the Strait of Georgia, and on the tidal waters tributary to the sea, straits, and sounds between the limits named.

Eighteenth district.—From the boundary between California and Mexico to the boundary between California and Oregon. It embraces all aids to navigation on the seacoast, bays, rivers, and other tidal waters of California.

Nineteenth district.—Embraces the Hawaiian Islands, the Midway Islands, the island of Guam, and the American Samoan Islands, and includes all aids to navigation in the waters thereof.

LOCATION OF DISTRICT OFFICES OF THE UNITED STATES LIGHTHOUSE SERVICE, WITH ADDRESS OF THE LIGHTHOUSE INSPECTOR.

District.	Address.	District.	Address.
1st.....	Portland, Me., Y. M. C. A. Building.	11th.....	Detroit, Mich., Post Office Building.
2d.....	Boston, Mass., 19 Congress Street.	12th.....	Milwaukee, Wis., Federal Building.
3d.....	Tompkinsville, N. Y.	13th.....	Rock Island, Ill., Federal Building.
4th.....	Philadelphia, Pa., Post Office Building.	14th.....	Cincinnati, Ohio, Customhouse.
5th.....	Baltimore, Md., New Customhouse.	15th.....	St. Louis, Mo., Customhouse.
6th.....	Charleston, S. C., Old Post Office Building.	16th.....	Ketchikan, Alaska.
7th.....	Key West, Fla.	17th.....	Portland, Oreg., Customhouse.
8th.....	New Orleans, La., Customhouse.	18th.....	San Francisco, Cal., Customhouse.
9th.....	San Juan, P. R.	19th.....	Honolulu, Hawaii, McCandless Building.
10th.....	Buffalo, N. Y., Federal Building.		

LIGHTHOUSE DEPOTS MAINTAINED ON JUNE 30, 1915.

[The principal depot of the district is indicated by the larger type.]

District.	Location.	District.	Location.
1st.....	Bear Island, Me.	8th.....	Fort San Jacinto, Galveston, Tex.
	LITTLE DIAMOND ISLAND, ME.		Mobile, Ala.
2d.....	LOVELLS ISLAND, BOSTON, MASS.		PORT EADS, LA.
	Woods Hole, Mass.	9th.....	Culebrita Island, P. R.
3d.....	Absecon, N. J.		Guantanamo Bay, Cuba.
	TOMPKINSVILLE, STATEN ISLAND, N. Y.		SAN JUAN, P. R.
	Goat Island, R. I.	10th.....	BUFFALO, N. Y.
	Juniper Island, Vt.		Erie, Pa.
	New London, Conn.		Maumee Bay, Ohio.
4th.....	Tucker Beach, N. J.		Rock Island, N. Y.
	EDGEMOOR, DEL.		Sandusky Bay (Cedar Point), Ohio.
	Lewes, Del.	11th.....	DETROIT, MICH.
5th.....	Annapolis, Md.		Minnesota Point, Minn.
	Chincoteague, Va.		St. Marys River, Mich.
	Lazaretto Point, Md.	12th.....	Charlevoix, Mich.
	Point Lookout, Md.		Milwaukee, Wis.
	PORTSMOUTH, VA.		ST. JOSEPH, MICH.
	Washington Wharf, D. C.	16th.....	KETCHIKAN, ALASKA.
	Washington, North Carolina.	17th.....	Ediz Hook, Wash.
6th.....	CASTLE PINCKNEY, CHARLESTON, S. C.		TONGUE POINT, OREG.
7th.....	Egmont Key, Fla.	18th.....	GOAT ISLAND, CAL.
	KEY WEST, FLA.	19th.....	HONOLULU, HAWAII.

EXPLANATION OF TABLE ON PAGE 31.

The table of aids to navigation includes all those maintained by the Lighthouse Service, a total of 14,544. On page 47 are given facts regarding the private aids to navigation, 662 in number, maintained under authority. In the statistics, relief light vessels are not counted and duplicate or auxiliary lights and fog signals are not counted, but double lights are counted separately when maintained on distinct structures or for distinct purposes. Buoys for the purpose of marking the positions of light vessels or larger buoys are not counted. Fog signals at light stations or on vessels are counted as separate aids, but not those attached to buoys, except in the case of submarine bells, which are counted as separate signals, whether on vessels or on buoys. Otherwise each buoy is counted only once, and if it is included in a higher class it is not in the lower class. Light-vessel lights are not counted separately.

[See note on p. 30.]

Class.	1st dist.	2d dist.	3d dist.	4th dist.	5th dist.	6th dist.	7th dist.	8th dist.	9th dist.	10th dist.	11th dist.	12th dist.	13th dist.	14th dist.	15th dist.	16th dist.	17th dist.	18th dist.	19th dist.	Total.
LIGHTED AIDS.																				
Hyper-radiant lights.																				1
First-order lights.	2	5	5	2	8		6	3									9	9		57
Second-order lights.	7	3	2			2	1	2	1		3	2						1	2	26
Third-order lights.	6	1	3	3		3	4	7	6	5	10	9				4	2	4	1	68
Three-and-one-half-order lights.		2	1		1			3	2	3	6	2								21
Fourth-order lights.	34	25	57	11	49	2	4	12	2	22	43	37				4	16	20	8	346
Fifth-order lights.	19	15	18	7	22	3	1	13	2	9	16	12						3	1	141
Sixth-order lights.	1	5	22	2	8	1			4	12	6	17								78
Range-lens lights.			9	11	4	8				4	3						2			41
Reflector lights.	2	7	1	1	4	37	2	2		4	24	1					2			100
Lens-lantern lights.	11	28	51	14	55	63	44	161	13	34	88	49				64	23	34	37	769
Minor lights.	2	17	175	30	270	160	31	79	1		81	8	465	568	663	33	234	16	4	2,837
Electric lights without lens.	1											6				1	8	3	1	14
Light-vessel stations.	1	11	10		8	4		2			5						3	2		53
Gas-lighted buoys.	5	43	49	11	58	6	5	22	2	29	71	17					7	6	4	335
Gas and whistling buoys.	6	3	11		10	7	5	5			1	1					6	8		63
Gas and aerial bell buoys.		5	16	4	11	5	3	1		3	11	15					3	4		81
Float lights.					2					10			67	37	1	6			1	124
Total.	97	170	430	109	510	310	106	312	33	136	368	176	532	605	664	112	315	110	60	5,155
UNLIGHTED AIDS.																				
Lights-on fixed aids.	85	108	344	94	421	288	93	282	31	93	240	137	465	568	663	106	296	90	55	4,499
Lights on floating aids.	12	62	86	15	89	22	13	30	2	43	88	39	67	37	1	6	19	20	5	656
Total lighted aids.	97	170	430	109	510	310	106	312	33	136	368	176	532	605	664	112	315	110	60	5,155
Fog signals, engine power.	19	21	37	5	15	4		3		10	38	46				9	23	28		258
Fog signals, clock power.	37	13	57	7	68	3		13		5	5	9				1	4	9		231
Fog signals, hand power.	12	2	3				1				2									20
Fog signals, electric.		2	4		2						4	5					2	4		18
Submarine signals.	2	7	9		8	5		3			5						4	2		50
Buoys, whistling (unlighted).	20	11	6		1	7	3	9	1								7	18	3	86
Buoys, bell (unlighted).	50	34	57	6	29	7	5	14	3			3				3	10	15	1	237
Buoys, iron.	144	77	157	112	282	277	230	171	106	15	25	26				123	132	43	52	1,972
Buoys, star (wood).	697	557	824	91	921	4		37		162	481	115	424			41	134	25	3	4,516
Daymarks, beacons, etc.	157	86	53	2	237	468	156	120	5		5	1	411	60		49	54	27	80	2,001
Total unlighted aids.	1,168	810	1,207	223	1,563	775	395	370	115	192	565	205	835	60		226	370	171	139	9,389
Grand total.	1,265	980	1,637	332	2,073	1,085	501	682	148	328	933	381	1,367	665	664	338	685	281	199	14,544

DETAILS AS TO CHARACTERISTICS OF LIGHTS (NOT INCLUDING LIGHT VESSELS).^a

	1st dist.	2d dist.	3d dist.	4th dist.	5th dist.	6th dist.	7th dist.	8th dist.	9th dist.	10th dist.	11th dist.	12th dist.	16th dist.	17th dist.	18th dist.	19th dist.	Total.
Fixed white:																	
Sixth order and above..	30	29	54	21	59	30	1	24	6	22	29	19	5	6	4	3	342
Lights below the sixth order.....	2	11	86	19	223	122	37	131	5	5	62	9	31	186	18	16	963
Lighted buoys.....		1	5					2		2		1	3				14
Fixed red:																	
Sixth order and above..	14	12	21	2	12	16		6	2	15	35	30				3	163
Lights below the sixth order.....	5	11	119	16	89	81	27	104	8	14	67	26	3	68	26	10	674
Lighted buoys.....		3	6					1		8			2			1	21
Flashing or occulting:																	
Sixth order and above..	15	16	40	27	20	16	13	9	4	20	35	16	3	22	32	7	295
Lights below the sixth order.....	7	23	21	9	15	20	13	5	1	15	42	23	64	11	5	16	534
Lighted buoys.....	11	47	65	15	79	18	13	25	2	32	83	32	1	16	18	4	461
Fixed and flashing, sixth order and above.....	12	6	3		5	3	2	3	5	2	10	14		3	1		69
Candlepower:																	
50,000 to 190,000.....	4	4	4	2	4	7	5	5	5	2	7	1	1	1	7		59
200,000 to 490,000.....		1	2	1	1	1	2	1			3	1		1	2	1	17
500,000 and over.....		1	1														3
Twin light stations.....	2	3															5
Stations with resident keepers.....	70	51	112	33	91	24	12	49	17	36	76	75	9	34	40	15	744

DETAILS AS TO ILLUMINANTS OF LIGHTS (NOT INCLUDING LIGHT VESSELS).^a

	1st dist.	2d dist.	3d dist.	4th dist.	5th dist.	6th dist.	7th dist.	8th dist.	9th dist.	10th dist.	11th dist.	12th dist.	16th dist.	17th dist.	18th dist.	19th dist.	Total.
Incandescent oil vapor.....	26	24	36	18	19	15	11	11	10	5	36	13	1	25	30	5	285
Oil (wick lamps):																	
Sixth order and above..	45	36	80	22	73	40	1	31	7	41	49	60	7	4	5	8	500
Lights below the sixth order.....	6	18	193	33	299	203	62	186	13	19	103	30	39	246	38	24	1,512
Lighted buoys.....										10							10
Acetylene:																	
Sixth order and above..		1	1	10	3	9	4			11	8	3		2	1	1	54
Lights below the sixth order.....	7	23	31	9	15	20	13	54		14	15	25	64	7	7	16	320
Lighted buoys.....	5	17	30	2	12	18	10	4			15	2		12	7	4	138
Oil gas:																	
Lights with mantles.....										2	56						58
Lights without mantles.....					13						1	1					15
Lighted buoys with mantles.....	1	3	22	2	52			4		32	68	29		4	7		224
Lighted buoys without mantles.....	5	31	24	11	15		3	20	2						4		117
Electric arc:																	
Sixth order and above..			1												1		2
Lights below the sixth order.....														2		1	3
Electric incandescent:																	
Sixth order and above..					1		2				9	1					13
Lights below the sixth order.....	1	4	2	2					1	1	3	2	1	10	8	1	36
Gas (coal), sixth order and above.....		2				1						1					4
Gas (oil), sixth order and above.....												1					1

^a Does not include the thirteenth, fourteenth, and fifteenth lighthouse (river) districts, in which there are 1,696 lights on fixed aids and 105 lights on floating aids, all of which use kerosene and are fixed.

DETAILS AS TO LIGHTS ON LIGHT VESSELS.

	1st dist.	2d dist.	3d dist.	5th dist.	6th dist.	8th dist.	10th dist.	11th dist.	12th dist.	17th dist.	18th dist.	Total.
Characteristics as to lights:												
1 fixed white light		2	1		1			4	5			13
2 fixed white lights		3	4	2	2	2				2	1	16
1 fixed red light		2							1			3
2 fixed red lights		2										2
1 fixed white and 1 fixed red light		1		3	1					1		6
1 white flashing, or occulting, and 1 fixed red light			2									2
1 white light, flashing or occulting	1	1	2	2			1	1			1	9
2 white occulting lights			1	1								2
Illuminants:												
Incandescent oil vapor		1			1							2
Acetylene	1		1	1								3
Oil (wick)		9	4	4	3	2		4	6	3	1	36
Oil (wick) and acetylene			1									1
Oil (wick) and oil gas with mantle			1									1
Oil gas with mantle				2								2
Electric arc			1									1
Electric incandescent		1	2	1			1	1			1	7
Illuminating apparatus:												
Fourth order		1			1							2
Reflector		4	3	3	2	1	1	2		1		17
Reflector and lens lantern		1	2									3
Lens lantern	1	5	5	5	1	1		3	6	2	2	31

DETAILS AS TO FOG SIGNALS.

Kind and how operated.	1st dist.	2d dist.	3d dist.	4th dist.	5th dist.	6th dist.	7th dist.	8th dist.	10th dist.	11th dist.	12th dist.	16th dist.	17th dist.	18th dist.	Total.
Steam:															
Whistle	9	7	6		5	2		2	4	31	31		4	7	108
Siren		1	1										1	1	4
Air:															
Whistle		3			1	1					6	1		1	13
Siren	2	3	22	1	4	1			5	7	9	4	7	17	82
Diaphone									1					2	3
Siren (electric)										1			1	4	6
Reed horn	8	5	8	4	5			1				4	11		46
Submarine bells:															
On light vessels, driven by compressed air	1	6	7		7	3		2		3	4		3	2	38
On bottom, electric power										2	1				3
On buoys, operated by sea	1	1	2		1	2		1					1		9
Bell:															
Clockwork	37	13	57	7	68	3		13	5	5	9	1	4	9	231
Electric		3	4		2					3			1		13
Engine		1													1
Hand	12		3							1					16
Horn:															
Hand		2					1			1					4
Gun:															
Acetylene													1		1
Total	70	45	110	12	93	12	1	19	15	54	60	10	34	43	578

* Auxiliary fog signals (75), whistling buoys (149), and bell buoys (318) are not included.

**LIGHTED AIDS, EXCLUSIVE OF LIGHTED BUOYS, IN COMMISSION ON
JUNE 30, 1915, USING ILLUMINANTS OTHER THAN LIQUID OIL.**

INCANDESCENT OIL-VAPOR LIGHTS (288 LIGHTS).

District.	Location.	District.	Location.
1st.....	Avery Rock, Me. Baker Island, Me. Boon Island, Me. Cape Neddick, Me. Dice Head, Me. Egg Rock, Me. Great Duck Island, Me. Halfway Rock, Me. Isles of Shoals, N. H. Libby Islands, Me. Matinicus Rock North, Me. Matinicus Rock South, Me. Monhegan Island, Me. Mount Desert, Me. Moose Peak, Me. Owl'shead, Me. Petit Manan, Me. Portsmouth Harbor (Newcastle), N. H. Rockland Breakwater, Me. Saddleback Ledge, Me. Seguin, Me. The Cuckolds, Me. Two-Bush Island, Me. West Quoddy Head, Me. Whaleback, Me. Whitehead, Me. Wood Island, Me.	3d (con.)...	Romer Shoal, N. Y. Sandy Hook, N. J. Sea Girt, N. J. Shinnecock Bay, N. Y. Staten Island, N. Y. Stratford Shoal (Middle Ground), N. Y. Tucker Beach, N. J. West Bank, N. Y. Watch Hill, R. I.
		4th.....	Bellevue Range Rear, Del. Brandywine Shoal, Del. Cape Henlopen, Del. Cape May, N. J. Delaware Breakwater Range Front, Del. Elbow of Cross Ledge, N. J. Fenwick Island, Del. Fourteen-Foot Bank, Del. Harbor of Refuge, Del. Listons Range Front, Del. Listons Range Rear, Del. Mahon River, Del. Miah Maull Shoal, N. J. Newcastle Range Rear, Del. Reedy Island Range Front, Del. Reedy Island Range Rear, Del. Schooner Ledge Range Rear, Pa. Ship John Shoal, N. J.
2d.....	Boston, Mass. Boston Light Vessel, No. 54, Mass. Cape Ann North, Mass. Cape Ann, South, Mass. Cape Cod, Mass. Cape Poge, Mass. Chatham North, Mass. Chatham South, Mass. Cuttyhunk, Mass. Dumpling Rock, Mass. Duxbury Pier, Mass. Gay Head, Mass. Long Island Head, Mass. Minots Ledge, Mass. Monomoy Point, Mass. Nantucket (Great Point), Mass. Nauset Beach, Mass. Nobska Point, Mass. Plymouth (Gurnet), Mass. Plymouth (Gurnet) Beacon, Mass. Race Point, Mass. Sankaty Head, Mass. Tarpaulin Cove, Mass. The Graves, Mass. West Chop, Mass.	5th.....	Assateague, Va. Bodie Island, N. C. Cape Charles, Va. Cape Hatteras, N. C. Cape Henry, Va. Cape Lookout, N. C. Cove Point, Md. Currituck Beach, N. C. Hog Island, Va. Hooper Island, Md. Ocracoke, N. C. Point No Point, Md. Sandy Point, Md. Sharps Island, Md. Smith Point, Va. Thimble Shoal, Va. Thomas Point Shoal, Md. Wolf Trap, Va. York Spit, Va.
		6th.....	Amelia Island, Fla. Cape Canaveral, Fla. Cape Fear, N. C. Cape Romain, S. C. Charleston, S. C. Frying-Pan Shoals Light Vessel No. 94, N. C. Georgetown, S. C. Hillsboro Inlet, Fla. Hunting Island, S. C. Jupiter Inlet, Fla. Mosquito Inlet, Fla. St. Augustine, Fla. St. Johns River, Fla. St. Simon, Ga. Sapelo, Ga. Tybee, Ga.
3d.....	Absecon, N. J. Barnegat, N. J. Beavertail, R. I. Block Island North, R. I. Block Island Southeast, R. I. Chapel Hill, N. J. Conover Beacon, N. J. Eatons Neck, N. Y. Elm Tree Beacon, N. Y. Execution Rocks, N. Y. Falkner Island, Conn. Fire Island, N. Y. Great Captain Island, Conn. Hereford Inlet, N. J. Horton Point, N. Y. Little Gull Island, N. Y. Ludlam Beach, N. J. Montauk Point, N. Y. New Dorp, N. Y. New London Ledge, Conn. North Hook Beacon, N. J. Old Field Point, N. Y. Pecks Ledge, Conn. Plum Island, N. Y. Point Comfort, N. J. Point Judith, R. I. Race Rock, N. Y.	7th.....	Alligator Reef, Fla. American Shoal, Fla. Anclote Keys, Fla. Carysfort Reef, Fla. Dry Tortugas, Fla. Egmont Key, Fla. Fowey Rocks, Fla. Gasparilla Island, Fla. Sand Key, Fla. Sanibel Island, Fla. Sombrero Key, Fla. Bolivar Point, Tex. Cape St. George, Fla. Cape San Blas, Fla. Matagorda, Tex.
		8th.....	

**LIGHTED AIDS, EXCLUSIVE OF LIGHTED BUOYS, IN COMMISSION ON JUNE 30, 1915,
USING ILLUMINANTS OTHER THAN LIQUID OIL—Continued.**

INCANDESCENT OIL-VAPOR LIGHTS—Continued.

District.	Location.	District.	Location.
8th (con.)..	Pensacola, Fla. Sabine Bank, Tex. Sabine Pass, La. Sand Island Range Front, Ala. Ship Shoal, La. South Pass Range Rear, La. Southwest Pass Range Rear, La.	12th (con.)..	Point Betsie, Mich. South Manitou, Mich. Sturgeon Bay Canal, Wis. Tall Point, Wis. Twin River Point, Wis. White Shoal, Mich.
9th.....	Arecibo, P. R. Cape Rojo, P. R. Cape San Juan, P. R. Culebrita Island, P. R. Mona Island, P. R. Muertos Island, P. R. Point Borinquen, P. R. Point Jiguero, P. R. Point Tuna, P. R. Port San Juan, P. R.	16th.....	Cape Hinchinbrook, Alaska.
10th.....	Braddock Point, N. Y. Buffalo, N. Y. Cleveland West Breakwater Pierhead, Ohio. Dunkirk, N. Y. Fairport, Ohio.	17th.....	Alki Point, Wash. Burrows Island, Wash. Cape Arago, Oreg. Cape Blanco, Oreg. Cape Disappointment, Wash. Cape Flattery, Wash. Cape Meares, Wash. Desdemona Sands, Oreg. Destruction Island, Wash. Ediz Hook, Wash. Grays Harbor, Wash. Heeeta Head, Oreg. Mukilteo, Wash. New Dungeness, Wash. North Head, Wash. Patos Islands, Wash. Point No Point, Wash. Point Wilson, Wash. Semihamoo Harbor, Wash. Smith Island, Wash. Tillamook Rock, Oreg. Umpqua River, Oreg. West Point, Wash. Willapa Bay, Wash. Yaquina Head, Oreg.
11th.....	Au Sable, Mich. Big Bay Point, Mich. Cheboygan, Mich. Crisp Point, Mich. Detroit River, Mich. Detour, Mich. Devils Island, Wis. Duluth Range Rear, Minn. Eagle Harbor, Mich. Fort Gratiot, Mich. Forty-Mile Point, Mich. Granite Island, Mich. Harbor Beach Harbor of Refuge East Entrance North, Mich. Huron Island, Mich. La Pointe, Wis. Manitou, Mich. Marquette, Mich. Michigan Island, Mich. Middle Island, Mich. Outer Island, Mich. Passage Island, Mich. Point Iroquois, Mich. Pointe aux Barques, Mich. Port Austin Reef, Mich. Portage Lake Ship Canals, Mich. Presque Isle, Mich. Rock of Ages, Mich. Round Island, Mich. Spectacle Reef, Mich. Split Rock, Minn. Stannard Rock, Mich. Superior Entry South Breakwater, Wis. Tawas, Mich. Thunder Bay Island, Mich. Two Harbors, Minn. Whitefish Point, Mich.	18th.....	Ano Nuevo Island, Cal. Bonita Point, Cal. Cape Mendocino, Cal. Carquinez Strait, Cal. East Brother Island, Cal. Farallon Island, Cal. Fort Point, Cal. Goat Island, Cal. Humboldt, Cal. Los Angeles Harbor, Cal. Mile Rocks, Cal. Piedras Blancas, Cal. Pigeon Point, Cal. Point Arena, Cal. Point Arguello, Cal. Point Cabrillo, Cal. Point Conception, Cal. Point Fermin, Cal. Point Hueneine, Cal. Point Loma, Cal. Point Montara, Cal. Point Pinos, Cal. Point Reyes, Cal. Point Sur, Cal. Punta Gorda, Cal. Roe Island, Cal. St. George Reef, Cal. San Luis Obispo, Cal. Santa Barbara, Cal. Trinidad Head, Cal. Barbers Point, Hawaii. Diamond Head, Hawaii. Kilauea Point, Hawaii. Makapuu Point, Hawaii. Molokai, Hawaii.
12th.....	Big Sable, Mich. Calumet Harbor, Ill. Cana Island, Wis. Chicago Harbor, Ill. Grand Traverse, Mich. Grossepoint, Ill. Old Mackinac Point, Mich.	19th.....	

ACETYLENE LIGHTS (379 LIGHTS).

1st.....	Clarks Point, Me. Emms Rock, Me. Fort Scammel Point, Me. House Island, Me. Portland Light Vessel, No. 74, Me. Steele Ledge Monument, Me. Stockton Harbor Range, Me.(2 lights).	2d.....	Bass River West Jetty, Mass. Billingsgate Island, Mass. Black Marsh Channel, Mass. Black Rocks, Mass. Canal Channel, Mass. (12 lights). Deacons Pond Jetty, Mass. Grassy Island Ledge, Mass.
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LIGHTED AIDS, EXCLUSIVE OF LIGHTED BUOYS, IN COMMISSION ON JUNE 30, 1915,
USING ILLUMINANTS OTHER THAN LIQUID OIL—Continued.

ACETYLENE LIGHTS—Continued.

District.	Location.	District.	Location.
2d (con.)...	Middle Ledge, Mass. Nantucket East Breakwater, Mass. Sandy Point, Mass. Upper Turn, Mass. White Rocks, Mass. Winthrop, Mass.	5th (con.)...	St. Pierre Island, Md. Winter Quarter Shoal Light Vessel No. 91, Va.
3d.....	Block Island Breakwater, R. I. Block Island Breakwater Outer Basin, R. I. Branford Reef, Conn. Centerville, N. J. Cold Spring Inlet, N. J. Cooks Sedges, No. 13, N. J. Cornfield Point Light Vessel No. 48, Conn. Fuller Rock, R. I. Glencove Breakwater, N. Y. Goose Neck Point, No. 11, N. J. Great Kills, N. J. Great Salt Pond Breakwater, Outer End, R. I. Jones Rocks, Conn. Junction, N. J. Little Silver, No. 9, N. J. Low Moor, No. 7, N. J. Lower Rocky Point, No. 2, N. J. Mill Rock Southerly, N. Y. Negro Point, N. Y. New London Harbor, Conn. Northeast End Light Vessel No. 44, N. J. Northwest Point, No. 2A, N. J. Pamrappo, N. J. Point Judith Harbor of Refuge Main Breakwater East, R. I. Point Judith Harbor of Refuge Main Breakwater Center, R. I. Point Judith Harbor of Refuge Main Breakwater West, R. I. Point Judith Harbor of Refuge East Breakwater, R. I. Saltersville, N. J. Sands Point, No. 4, N. J. Sandy Point Breakwater, Conn. Sea Haven, N. J. South Hook Beacon, N. J. U. S. Dike, Nos. 1 and 3, N. J. (2 lights).	6th.....	Bald Head, N. C. Bloody Point Range, Ga. (2 lights). Brickyard Creek, S. C. Cape Fear River, N. C. (14 lights). Dawho River, S. C. (2 lights). Hilton Head Range Rear, S. C. Jones Island Range, Ga. (2 lights). New Channel Range Front, N. C. New Channel Range Front (supple- mental), N. C. Paris Island Range Front, S. C. Tybee Range Front, Ga. St. Andrews Sound, Ga. Winyah Bay South Jetty, S. C.
4th.....	Bellevue Range Front, Del. Billingsport Range Front, N. J. Cherry Island Range Front, Del. Cohansey, N. J. Deadman Shoal, N. J. Eagle Point Range, N. J. (2 lights). East Point, N. J. Egg Island, N. J. Finns Point Jetty, N. J. Grubbs Landing, Del. Horseshoe Range West Group Lower Front, Pa. Maurice River Range, N. J. (2 lights). Mispillion River, Del. Salem River Range, N. J. (2 lights). Symrna Range, Del. (2 lights).	7th.....	Charlotte Harbor, Fla. Cut J Range, Fla. (2 lights). Eastern Triangle, Fla. East Washerwoman Shoal, Fla. Egmont Key Range Front, Fla. Key West, Fla. Mangrove Point, Fla. Middle Ground, Fla. Mosquito Bank, Fla. Nine-Foot Shoal, Fla. North Bank, Fla. Northwest Bar, Fla. Northwest Passage, Fla. Peace Creek, Fla. Tortugas Harbor, Fla. Withlacoochee River, Fla.
5th.....	Alligator River, N. C. Battle Creek Shoal, Md. Brewerton Channel Range Front, Md. Cutoff Channel Range, Md. (2 lights). Dividing Creek, Va. Fishing Point, Outer, Va. Fort McHenry, Md. Great Island, N. C. Gulldford Flats, Va. Hack Neck Shoal, Va. Inner Middle Ground, N. C. Jarvis Point Shoal, Va. Manokin River, Md. Petersons Point, Md. Reeds Hammock, N. C.	8th.....	Caucus Cut and Pensacola Bay Ranges Rear, Fla. Cutoff Channel, Ala. (2 lights). Cutoff Channel Range, Ala. (2 lights). East Bank, Tex. Galveston Bay Channel, Tex. (9 lights). Galveston Dike, West End, Tex. Galveston Jetty, Tex. Galveston North Jetty, Tex. Hitchcock Reef, Tex. Mobile Ship Channel, Ala. (20 lights). Port Arthur Canal, Tex. Port Bolivar Range, Tex. (2 lights). Sabine Pass Channel, La. Sabine Pass Entrance and Inner Ranges, La. (4 lights). Sand Island Range Rear (twin), Ala. (2 lights). Seabrook, Tex. Second Turn, Tex. Southwest Pass, East Jetty, La. Texas City Channel, Tex. (4 lights).
		10th.....	Ashtabula East Breakwater, Ohio. Ashtabula West Breakwater Pier- head, Ohio. Carleton Island, N. Y. Chaumont Harbor, N. Y. Cherry Island, N. Y. Cleveland East Entrance, Ohio. Cleveland East Pierhead, Ohio. Cleveland East Breakwater, Ohio. Cleveland East Pier, Ohio. Cleveland West Breakwater, Ohio. Cleveland West Pier, Ohio. Conneaut West Breakwater, Ohio. Fairport West Pierhead, Ohio. Fairport West Pier, Ohio. Horseshoe Reef, N. Y. Lorain East Breakwater Pierhead, Ohio. Lorain West Breakwater Pierhead, Ohio. Niagara River Range, N. Y. (2 lights). South Buffalo Pierhead, N. Y. Strawberry Island Lower Cut Range, N. Y. (2 lights).

LIGHTED AIDS, EXCLUSIVE OF LIGHTED BUOYS, IN COMMISSION ON JUNE 30, 1915,
USING ILLUMINANTS OTHER THAN LIQUID OIL—Continued.

ACETYLENE LIGHTS—Continued.

District.	Location.	District.	Location.
10th (con.).	Strawberry Island Upper Cut Range, N. Y. (2 lights).	16th (con.).	Lincoln Rock, Alaska.
	Wells Island, N. Y.		Lone Tree Point, Alaska.
11th.....	Au Sable Pierhead, Mich.		Lord Rocks, Alaska.
	Grand Island, Harbor Range, Mich. (2 lights).		Mellen Rock, Alaska.
	Gull Rock, Mich.		Middle Rock, Alaska.
	Harbor Beach Harbor of Refuge East Entrance South, Mich.		Midway Islands, Alaska.
	Peach Island Range, Mich. (2 lights).		Midway Rock, Alaska.
	Isle Royal, Mich.		Mitkof Island, Alaska.
	Livingstone Channel, Mich. (8 lights)		Ocean Cape, Alaska.
	Portage River Pierhead, Mich.		Petersburg Float, 24, Alaska.
	Port Wing, East Breakwater, Mich.		Pilot Rock, Alaska.
	Sturgeon Point, Mich.		Point Arden, Alaska.
	Superior Harbor Basin No. 1, Wis.		Point Ellis, Alaska.
	Superior Entry Inner North Breakwater, Wis.		Point Elrington, Alaska.
	Superior Entry North Breakwater, Wis.		Point Gardner, Alaska.
	Superior Entry Inner South Pierhead, Mich.		Point Helen, Alaska.
12th.....	Bank Point, Mich.		Point Hugh, Alaska.
	Chicago Breakwater North, Ill.		Point Retreat, Alaska.
	Chicago Breakwater South, Ill.		Point Sherman, Alaska.
	Elbow, Wis.		Point Young, Alaska.
	Frankfort South Pierhead, Mich.		Rocky Island, Alaska.
	Grand Haven North Pierhead, Mich.		Rugged Island, Alaska.
	Holland Range Front, Mich.		Seal Island, Alaska.
	Indiana Harbor Range, Ind. (2 lights).		Shakan Bay, Alaska.
	Kenosha Breakwater, Wis.		Shelter Island, Alaska.
	Kewaunee North Pierhead, Wis.		Ship Island, Alaska.
	Ludington North Breakwater, Mich.		Smith Island, Alaska.
	Ludington South Breakwater, Mich.		Spanish Islands, Alaska.
	Manistique West Breakwater, Mich.		Spire Island Reef, Alaska.
	Manitowoc South Breakwater, Wis.		Strait Island, Alaska.
	Michigan City Breakwater, Mich.		Stikine Strait, Alaska.
	Milwaukee Breakwater, Wis.		Sukoi Islets, Alaska.
	Milwaukee South Pierhead, Wis.		Tenakee Inlet, Alaska.
	Muskegon North Pierhead, Mich.		Turnabout Island, Alaska.
	Oconto Harbor South Pierhead, Wis.		Vank Island, Alaska.
	Petoskey, Mich.		Vichnefski Rock, Alaska.
	Racine Pierhead, Wis.		Warburton Island, Alaska.
	Saugatuck North Pierhead, Mich.		Whale Island, Alaska.
	Saugatuck South Pierhead, Mich.		Windy Bay, Alaska.
	Saunders Point, Mich.		Woody Island, Alaska.
	Sheboygan Breakwater, Wis.	17th.....	Columbia River Entrance Range, Oreg., Wash. (2 lights).
	Squaw Point, Mich.		Lime Kiln, Wash.
	Waukegan Breakwater, Wis.		Lower Sands, Oreg.
16th.....	Battery Point, Alaska.		Marrowstone Point, Wash.
	Beauclerc Island, Alaska.		Neah Bay, Wash.
	Blank Island, Alaska.		Peapod Rocks, Wash.
	Busby Island, Alaska.		Turn Rock, Wash.
	Bushy Island, Alaska.		Viti Rocks, Wash.
	Caines Head, Alaska.	18th.....	Anacapa Island, Cal.
	Cape Chacon, Alaska.		Ballast Point, Cal.
	Cape Fanshaw, Alaska.		La Playa, Cal.
	Cape St. Elias, Alaska.		Light No. 5, Cal.
	Cape Spencer, Alaska.		Redding Rock, Cal.
	Cape Stephens, Alaska.		Richardson Rock, Cal.
	Cape Strait, Alaska.		San Diego Entrance Range, Cal. (2 lights).
	Channel Island, Tongass Narrows, Alaska.	19th.....	Hanapepe, Hawaii.
	Channel Island, Orea Bay, Alaska.		Haweia Point, Hawaii.
	Dewey Rocks, Alaska.		Kahala Point, Hawaii.
	East Clump, Alaska.		Kahului Breakwater, Hawaii.
	Elrington Passage, Alaska.		Kauliki Head, Hawaii.
	Eye-Opener, Alaska.		Kaunakakai Range, Hawaii (2 lights).
	Fairway Island, Alaska.		Kawaihae, Hawaii.
	Grave Point, Alaska.		Keahole Point, Hawaii.
	Guard Islands, Alaska.		Kukuihaele, Hawaii.
	Hog Rocks, Alaska.		Laa Point, Hawaii.
	Johnstone Point, Alaska.		Lae o Kokole, Hawaii.
	Key Reef, Alaska.		Laupahoehoe, Hawaii.
			McGregor Point, Hawaii.
			Mahukona, Hawaii.
			Molokini, Hawaii.
			Pauwalu Point, Hawaii.

LIGHTED AIDS, EXCLUSIVE OF LIGHTED BUOYS, IN COMMISSION ON JUNE 30, 1915,
USING ILLUMINANTS OTHER THAN LIQUID OIL—Continued.

ELECTRIC ARC LIGHTS (6 LIGHTS).

District.	Location.	District.	Location.
3rd.....	Ambrose Channel Light Vessel, No. 87, N. Y.	18th.....	Alcatraz Island, Cal.
	Navesink, N. J.	19th.....	Waiakea, Hawaii (no lens).
17th.....	Astoria Range, Oreg. (2 lights; no lens).		

ELECTRIC INCANDESCENT LIGHTS (51 LIGHTS).

1st.....	Kennebunkport Pier, Me. (no lens).	12th.....	Charlevoix North Pierhead, Mich.
2d.....	Canal Breakwater, Mass. .		Escanaba, Mich.
	Gallups Island, Mass.	16th.....	Manistique East Breakwater, Mich.
	Great Harbor Range, Mass. (2 lights).		Sitka Harbor, Alaska (no lens).
	Nantucket Shoals Light Vessel, No. 85, Mass.	17th.....	Coquille River Entrance Range, Oreg. (2 lights; no lens).
3d.....	Aunt Phebe Rock, N. Y.		Coquille Upper Channel Range, Oreg. (2 lights; no lens).
	Fire Island Light Vessel, N. Y.		Fort Stevens Wharf, Oreg.
	Goat Island Shoal, R. I.		Linnton Landing, Oreg.
	Overfalls Light Vessel, No. 69, Del.		Point Hudson, Wash.
4th.....	Schuylkill River Range, Pa. (2 lights).		Smith Point, Oreg. (no lens).
5th.....	Diamond Shoal Light Vessel, No. 71, N. C.		Tacoma Waterway, Wash.
	Lazaretto Point, Md.		Whatcom Waterway, Wash.
7th.....	Key West Main Ship Channel Range, Fla. (2 lights).	18th.....	Brosnons Wharf, Cal.
9th.....	Puntilla Point, P. R.		Immigration Station, Cal.
10th.....	Buffalo South Pier, N. Y.		Mare Island Dike, Nos. 4, 8, 14, Cal. (3 lights; no lens).
11th.....	Alpena, Mich.		Point Blunt, Cal.
	Atlantic Point, Mich.		Point Stuart, Cal.
	Center Pierhead, Mich.		San Antonio Creek, Cal.
	Cole Creek, Mich.		San Francisco Light Vessel, No. 70, Cal.
	Duluth Range Front, Mich.		
	Fort Gratiot Range, Mich. (2 lights).		
	Marquette Breakwater, Mich.		
	Osceola Point, Mich.		
	Vidal Shoals Channel Range, Mich. (2 lights).		

GAS LIGHTS (78 LIGHTS).

2d.....	Newburyport Upper Harbor Range, Mass. (2 lights; coal gas).	11th (con.)	Grand Marais West Breakwater, Minn. (oil gas).
3d.....	Scotland Light Vessel, No. 11, N. J. (oil gas).		Grosse Isle South Channel Range, Mich. (2 lights; oil gas).
5th.....	Bush Bluff Light Vessel, No. 97, Va. (oil gas).		Pilgrim Point, Mich. (oil gas).
	Currituck Sound, N. C. (4 lights; oil gas).		Portage Lake Ship Canals, East Breakwater, Mich. (oil gas).
	Fenwick Island Shoal Light Vessel, No. 52, Del. (oil gas).		Portage Lake Ship Canals, West Breakwater, Mich. (oil gas).
	North Landing River, N. C. (5 lights; oil gas).		St. Clair Flats Canal East Pierhead, Mich. (oil gas).
	North River, N. C. (4 lights; oil gas).		St. Marys River, Mich. (45 lights; oil gas).
6th.....	Main Channel Range Rear (St. Phillips Church), S. C. (coal gas).	12th.....	Chicago Outer Breakwater, Northwest End, Ill. (oil gas).
10th.....	Manhattan Range, Ohio (2 lights).		Dunlap Reef Range Front, Wis. (oil gas).
11th.....	Brush Point Range, Mich. (2 lights; oil gas).		North Point (Milwaukee), Wis. (coal gas).
	Ecorse Range Rear, Mich. (oil gas).		

LIGHTS ESTABLISHED DURING THE FISCAL YEAR 1915.

[230 lights.]

District.	Location.	Order.
1st.....	Clarks Point, Me.....	Minor (acetylene).
	Emms Rock, Me.....	Lens lantern (acetylene).
	Fort Scammel Point, Me.....	Minor (acetylene).
2d.....	Stockton Harbor Range, Me. (2 lights).....	Lens lantern (acetylene).
	Canal Breakwater, Mass.....	Lens lantern (electric).
	Canal Channel, Mass. (12 lights).....	Lens lantern (acetylene).
	Deacons Pond Jetty, Mass.....	Minor (acetylene).
3d.....	Winthrop, Mass.....	Do.
	Fordham Point North Dyke, N. Y.....	Minor.
	Fordham Point South Dyke, N. Y.....	Do.
	Rock Landing Range, Conn. (2 lights).....	Do.
	Stonehouse Bar Dike, N. Y.....	Do.
	Stuyvesant Dike, N. Y.....	Do.
	Van Wies Point Dike, N. Y.....	Do.
4th.....	Chester Range, Del. (2 lights).....	Reflector.
	Deadman Shoal, N. J.....	Minor (acetylene).
	Marcus Hook Range, Pa. (2 lights).....	Reflector.
	Salem Creek Range Rear, N. J.....	Lens lantern (acetylene).
5th.....	Abel Bay, N. C.....	Minor.
	Atlantic, N. C.....	Do.
	Barnes Point Shoal, Va.....	Do.
	Bath Creek, N. C.....	Do.
	Battle Creek Shoal, Md.....	Minor (acetylene).
	Carolina City, N. C.....	Minor.
	Chincoteague Bay, Va. (5 lights).....	Do.
	Clay Island Shoal, Md.....	Do.
	Fairview Point, Md.....	Do.
	Flowery Gap, N. C.....	Do.
	Fort Foote Wharf, Md.....	Do.
	Glymont Wharf, Md.....	Do.
	Goulds Lump, N. C.....	Do.
	Gulldford Flats, Va.....	Minor (acetylene).
	Hack Neck, Va.....	Do.
	Halls Point, N. C.....	Minor.
	Herring Island Shoal, Md.....	Do.
	Inner Middle Ground, N. C.....	Minor (acetylene).
	Jarvis Point Shoal, Va.....	Do.
	Manokin River, Md.....	Do.
	Morehead City, N. C.....	Minor.
	Morehead City Channel, N. C.....	Do.
	Newport Marshes Lower, N. C.....	Do.
	Occoquan Bay Float, No. 1, Va.....	Do.
	Peltiers Creek, N. C.....	Do.
	Petersons Point, Md.....	Minor (acetylene).
	Pooles Island Range, Md. (2 lights).....	Minor.
	Poplar Island Narrows, Md.....	Do.
	St. Pierre Island, Md.....	Minor (acetylene).
	Spooners Creek, N. C.....	Minor.
	Sunken Island, Va.....	Do.
	Upper Mud Bar Float, No. 6, Va.....	Do.
	Wallace Channel, N. C. (3 lights).....	Do.
	Western Channel, N. C.....	Do.
6th.....	White Stone Point, Md.....	Do.
	Amelia River, Fla. (5 lights).....	Do.
	Barnwell Island Flats, No. 14, Ga.....	Do.
	Brickyard Creek, S. C.....	Minor (acetylene).
	Dawho River, S. C. (2 lights).....	Do.
	Elba Island Flats, No. 11, Ga.....	Minor.
	Fig Island Jetty, Ga.....	Do.
	Floralbluff, No. 19D, Fla.....	Do.
	Fort Oglethorpe, Ga.....	Lens lantern.
	Mile Point Lower Range Rear, Fla.....	Minor.
	Mile Point Upper Range, Fla. (2 lights).....	Do.
	New Channel Range Front, supplemental, N. C.....	Minor (acetylene).
	Sawpit Creek, Fla.....	Minor.
	South Channel Range Front, supplemental, S. C.....	Do.
	The Sisters Entrance Range, Fla. (2 lights).....	Do.
7th.....	Eastern Triangle, Fla.....	Minor (acetylene).
	Egmont Key Range Front, Fla.....	Lens lantern (acetylene).
	Matanzas Pass, Fla.....	Minor.
	North Bank, Fla.....	Lens lantern (acetylene).
8th.....	Pine Island Sound, Fla. (6 lights).....	Minor.
	Boggy Bayou, Fla.....	Do.
	Cobbs Point, Fla.....	Do.
	Four Mile Point, Fla.....	Do.
	Galveston Bay Channel Entrance Range, Tex. (2 lights).....	Lens lantern (acetylene).
	Galveston Bay Channel, Tex. (3 lights).....	Do.
	Hurricane Crossing Range, Fla. (2 lights).....	Minor.
	Light No. 8C, Ala.....	Lens lantern (acetylene).
	Lower Pritchard Long Point, Fla.....	Minor.
	Pass aux Herons Channel, Ala. (4 lights).....	Lens lantern.
	Upper Pritchard Long Point, Fla.....	Minor.

LIGHTS ESTABLISHED DURING THE FISCAL YEAR 1915—Continued.

District.	Location.	Order.
9th.....	Puntilla Point, P. R.....	Minor (electric).
10th.....	Ashtabula East Breakwater, Ohio.....	Lens lantern (acetylene).
	Ashtabula West Breakwater Pierhead, Ohio.....	Do.
	Buffalo South Pier, N. Y.....	Lens lantern (electric).
	Cleveland East Entrance, Ohio.....	Lens lantern (acetylene).
	Conneaut East Pier, Ohio.....	Lens lantern.
	Conneaut West Breakwater, Ohio.....	Lens lantern (acetylene).
11th.....	Center Pierhead, Mich.....	Reflector (electric).
	Livingstone Channel, Mich. (2 lights).....	Lens lantern (acetylene).
	Superior Harbor Basin, No. 1, Wis.....	Do.
12th.....	Manistique West Breakwater, Mich.....	Do.
	Manistique West Pierhead, Mich.....	Lens lantern.
	Muskegon North Pierhead, Mich.....	Lens lantern (acetylene).
	Oconto Harbor South Pierhead, Wis.....	Do.
	Saugatuck North Pierhead, Mich.....	Do.
13th.....	12 minor lights.....	
	10 lighted spar buoys.....	
14th.....	2 minor lights.....	
15th.....	43 minor lights.....	
16th.....	Gray Cliff, Alaska.....	Minor.
	Inner Point Sophia, Alaska.....	Lens lantern.
	Rugged Island, Alaska.....	Lens lantern (acetylene).
	Sitka Harbor, Alaska.....	No Lens (electric).
	South Flat North End, Alaska.....	Minor.
17th.....	Jewett Landing Range, Oreg. (2 lights).....	Do.
	Prairie Channel, Oreg.....	Do.
	Richardson, Wash.....	Do.
	South Channel Range, Oreg. (2 lights).....	Reflector.
	Steamboat Slough, Wash.....	Minor.
	Tongue Point Channel Range, Oreg. (2 lights).....	Do.
	Tongue Point Crossing, Oreg.....	Do.
	Turn Rock, Wash.....	Minor (acetylene).
18th.....	Junction Point, Cal.....	Minor.
	Point Blunt, Cal.....	Lens lantern (electric).
	Point Stuart, Cal.....	Do.
	San Antonio Creek, Cal.....	Do.
19th.....	Cabras Island, Guam.....	Minor.
	Port Apra, Guam.....	Do.
	Sumay Point, Guam.....	Do.

LIGHTS WHERE ILLUMINATION WAS IMPROVED DURING THE FISCAL YEAR 1915.

FLASHING OR OCCULTING LIGHTS CHANGED FROM FIXED LIGHTS (29 LIGHTS).

District.	Location.	District.	Location.
2d.....	Grassy Island Ledge, Mass.	12th.....	Chicago Breakwater South, Ill.
	Middle Ledge, Mass.		Ludington North Breakwater, Mich.
5th.....	Dividing Creek, Va.		Squaw Point, Mich.
	Great Island, N. C.	16th.....	Cape Sarichef, Alaska.
	Brewerton Channel Range Front, Md.		Elrington Passage, Alaska.
6th.....	Hilton Head Range Front, S. C.	17th.....	Fort Stevens Wharf, Oreg.
	St. Andrews Sound, Ga.		Lower Sands, Oreg.
7th.....	East Washerwoman Shoal, Fla.		Point No Point, Wash.
	Foway Rocks, Fla.	19th.....	Diamond Head, Hawaii.
	Key West, Fla.		Kawahae, Hawaii.
	Middle Ground, Fla.		Keahole, Hawaii.
	Mosquito Bank, Fla.		Laupahoehoe, Hawaii.
	Nine-Foot Shoal, Fla.		McGregor Point, Hawaii.
	Sombrero Key, Fla.		Mahukona, Hawaii.
10th.....	Carleton Island, N. Y.		

INCANDESCENT OIL-VAPOR LIGHTS CHANGED FROM OIL-WICK LIGHTS (21 LIGHTS).

2d.....	Boston Light Vessel, No. 54, Mass.	11th (con.).	La Pointe, Wis.
5th.....	Thimble Shoal, Va.		Michigan Island, Mich.
6th.....	Amelia Island, Fla.		Middle Island, Mich.
7th.....	Gasparilla Island, Fla.		Port Austin Reef, Mich.
10th.....	Braddock Point, N. Y.		Round Island, Mich.
	Buffalo, N. Y.		Tawas, Mich.
11th.....	Cheboygan, Mich.	17th.....	Mukilteo, Wash.
	Crisp Point, Mich.		Point No Point, Wash.
	Devils Island, Wis.		Willapa Bay, Wash.
	Forty-Mile Point, Mich.	19th.....	Molokai, Hawaii.
	Granite Island, Mich.		

LIGHTS WHERE ILLUMINATION WAS IMPROVED DURING THE FISCAL YEAR 1915—
Continued.

ACETYLENE OR OTHER LIGHTS CHANGED FROM OIL-WICK LIGHTS, ETC. (32 LIGHTS).

District.	Location.	District.	Location.
2d.....	Grassy Island Ledge, Mass.	11th.....	Atlantic Point, Mich. (electric).
5th.....	Middle Ledge, Mass.		Cole Creek, Mich. (electric).
	Bush Bluff Light Vessel, No. 97, Va.		Fort Gratiot Range, Mich. (2 lights, electric).
	(oil gas from electricity).	12th.....	Osceola Point, Mich. (electric).
	Brewerton Channel Range Front, Md.		Chicago Breakwater South, Ill.
	Dividing Creek, Va.	16th.....	Squaw Point, Mich.
	Great Island, N. C.	17th.....	Elrington Passage, Alaska.
	Winter-Quarter Shoal Light Vessel, No. 91, Va.		Fort Stevens Wharf, Oreg. (electric).
6th.....	Hilton Head Range Front, S. C.		Linnton Landing, Oreg. (electric).
	St. Andrews Sound, Ga.	19th.....	Lower Sands, Oreg.
7th.....	East Washerwoman Shoal, Fla.		Kawahae, Hawaii.
	Key West, Fla. (from incandescent oil vapor).		Keahole Point, Hawaii.
	Middle Ground, Fla.		Laupahoehoe, Hawaii.
	Mosquito Bank, Fla.		McGregor Point, Hawaii.
	Nine-Foot Shoal, Fla.		Mahukona, Hawaii.
10th.....	Carleton Island, N. Y.		
	Horseshoe Reef, N. Y.		
	Manhattan Range, Ohio (2 lights, oil gas).		

LIGHTS DISCONTINUED DURING THE FISCAL YEAR 1915.

[102 lights, including float lights.]

District.	Location.	Order.
1st.....	Moosabec Reach, Me.....	Minor.
3d.....	Rock Landing, Conn.....	Do.
4th.....	Salem Creek, N. J.....	Lens lantern (acetylene).
5th.....	Occoquan Bay, No. 1, Va.....	Minor.
	Upper Mud Bar, No. 6, Va.....	Do.
6th.....	Bull, No. 1, S. C.....	Do.
	Cowhead Shoal Range, S. C. (2 lights).....	Do.
	East Marsh Island, No. 2, S. C.....	Do.
	Fig Island Range, S. C. (2 lights).....	Reflector.
	Little Cumberland Island, Ga.....	Third.
	Mile Point Cuts A & B Ranges, Fla. (4 lights).....	Minor.
	Oglethorpe Range Front, Ga.....	Do.
	Sisters Rocks, No. 4, S. C.....	Do.
	West Marsh Island, No. 6, S. C.....	Do.
7th.....	Cedar Keys, Fla.....	Fourth.
8th.....	Texas City Channel, No. 3, Tex.....	Lens lantern (acetylene).
10th.....	Conneaut Harbor Range Front, Ohio.....	Fifth.
	E. E. Rice Wreck, Ohio.....	Minor.
11th.....	Ohio Central Dock, No. 2, Minn.....	Do.
	Rice Point Channel, No. 1, Minn.....	Do.
	Stag Island Lower, Mich.....	Do.
12th.....	Kalamazoo, Mich.....	Fifth.
13th.....	14 minor lights.....	
	6 lighted spar buoys.....	
14th.....	2 minor lights.....	
15th.....	46 minor lights.....	
16th.....	Smugglers Cove, Alaska.....	Minor.
17th.....	Beacon No. 1, Oreg.....	Do.
	Morgan Wharf, Wash.....	Do.
	Taylor Sands, Oreg.....	Do.
	Twin Rocks, Wash.....	Do.
19th.....	Honolulu Channel, No. 8, Hawaii.....	Lens lantern.
	Hole in the Wall, Guam.....	Minor.

LIGHTS, EXCLUSIVE OF LIGHTED BUOYS, WHICH WILL PROBABLY BE ESTABLISHED DURING THE FISCAL YEAR 1916.

District.	Location.	Probable date of establishment.	Order.	Illuminant.	Additional keepers or laborers required.
3d.....	Mattituck, N. Y.....	Aug., 1915	Lens lantern.	Acetylene....	0
	Rondout, N. Y.....	do.	Sixth order...	Oil wick.....	0
	Sayville, N. Y.....	Oct., 1915	Lens lantern.	Electric incandescent.	0
4th.....	Tuckerton, N. J.....		Minor (2)....	Oil wick.....	1
	Biles Island, N. J.....		do.	Acetylene....	0
	Broadkill Jetty, Del.....		Minor.....	do.	0
	Mud Island, Pa.....	Aug., 1915	Minor (2)....	do.	0
	Oldmans Creek, N. J.....		do.	do.	0
	Penn Manor, Pa.....		do.	do.	0
5th.....	Raccoon Creek, N. J.....	July, 1915	do.	do.	0
	Cherrystone Channel, Va.....	do.	Minor.....	Oil wick.....	0
	New River, N. C.....	Sept., 1915	Minor (3)....	do.	1
	Oyster Creek, N. C.....	Aug., 1915	Minor.....	Acetylene....	0
	Slocum Creek, N. C.....	Mar., 1916	do.	Oil wick.....	1
6th.....	Fort Sumter Range Front, S. C.....	July, 1915	Range lens.	Acetylene....	0
7th.....	Charlotte Harbor, Fla.....	Apr., 1916	Lens lantern (2).	Oil wick.....	0
	Coon Creek, Fla.....	Aug., 1915	Minor.....	Acetylene....	0
	Cuts B and D, Tampa Bay, Fla.....	May, 1916	Lens lantern (4).	do.	0
	Cut G, Tampa Bay, Fla.....	Feb., 1916	Lens lantern (2).	Oil wick.....	0
	Cut H Range Rear, Caloosahatchee River, Fla.....	do.	Minor.....	do.	0
	Cut K, Tampa Bay, Fla.....	Jan., 1916	Lens lantern.	do.	0
	Dredged Cut, Fla.....	Apr., 1916	Reflector.	do.	0
	Miami, Fla.....	do.	Minor (2)....	Acetylene....	0
	Hillsboro Bay, Fla.....	May, 1916	Reflector.	Oil wick.....	0
	Manatee River, Fla.....	Mar., 1916	Minor (5)....	do.	0
	South Bar, Cedar Keys, Fla.....	Jan., 1916	Minor (3)....	do.	0
8th.....	Calcasieu-Sabine Canal, La. and Tex.....	Sept., 1915	Minor.....	do.	0
	Neches River, La.....	do.	Minor (2)....	do.	1
	Sabine-Neches Canal, La.....	do.	Minor (5)....	do.	1
	Sabine River, La.....	do.	Minor (6)....	do.	1
	Texas City Channel, Tex.....	do.	Minor.....	do.	1
9th.....	Cucaracha, P. R.....	Oct., 1915	Lens lantern (6).	Acetylene....	0
	Fajardo Roads, P. R.....	Jan., 1916	Sixth order...	Oil gas.....	0
	Guayanilla, P. R.....	June, 1916	Minor (2)....	Electric incandescent.	1
	Parse Shoal, P. R.....	do.	do.	Oil gas.....	0
	Playa Cuaba, P. R.....	Jan., 1916	do.	do.	0
10th.....	Ballast Island, Ohio.....	Oct., 1915	do.	do.	0
	Linda Island, N. Y.....	do.	Lens lantern.	Acetylene....	0
11th.....	Ashland Breakwater, Wis.....	Oct., 1915	do.	do.	0
	Livingstone Channel, Mich.....	July, 1915	Fourth order.	Electricity....	1
12th.....	Manistee South Breakwater, Mich.....	Oct., 1915	Lens lantern.	Acetylene....	0
	Menominee Pierhead, Mich.....	Nov., 1915	do.	do.	0
	Sheboygan South Pierhead, Wis.....	Oct., 1915	Reflector.	Oil wick.....	0
	South Haven Pierhead, Mich.....	Sept., 1915	Lens lantern.	Acetylene....	0
16th.....	Akutan Harbor, Alaska.....	July, 1915	Reflector.	Oil wick.....	0
	Anchor Point, Alaska.....	Aug., 1915	Minor.....	do.	1
	Barlow Islands, Alaska.....	Oct., 1915	Lens lantern.	do.	0
	Barren Islands, Alaska.....	June, 1916	do.	do.	0
	Beck Island, Alaska.....	July, 1915	do.	do.	0
	Clear Point, Alaska.....	Sept., 1915	Minor.....	Oil wick.....	1
	East Chugach, Alaska.....	July, 1915	Lens lantern.	Acetylene....	0
	East Forelands, Alaska.....	Aug., 1915	do.	do.	0
	Flat Island, Alaska.....	July, 1915	do.	do.	0
	Gambier Entrance Reef, Alaska.....	May, 1916	do.	do.	0
	Hawk Inlet East Shoal, Alaska.....	Oct., 1915	Minor.....	Oil wick.....	1
	Hawk Inlet Entrance, Alaska.....	Sept., 1915	Lens lantern.	Acetylene....	0
	Kingsmill Point, Alaska.....	do.	do.	do.	0
	Lewis Reef, Alaska.....	do.	do.	do.	0
	Little Island, Alaska.....	Oct., 1915	do.	do.	0
	Low Point, Alaska.....	do.	do.	do.	0
	Marmion Island, Alaska.....	do.	do.	do.	0
	McClellan Rock, Alaska.....	Sept., 1915	do.	do.	0
	Middle Point, Alaska.....	Aug., 1915	do.	do.	0
	Molra Rock, Alaska.....	Sept., 1915	do.	do.	0
	Naked Island, Alaska.....	do.	do.	do.	0

LIGHTS, EXCLUSIVE OF LIGHTED BUOYS, WHICH WILL PROBABLY BE ESTABLISHED
DURING THE FISCAL YEAR 1916—Continued.

District.	Location.	Probable date of establishment.	Order.	Illuminant.	Additional keepers or laborers required.
16th	Narrow Point, Alaska.....	Sept., 1915	Lens lantern.	Acetylene....	0
	Otstola Island, Alaska.....	do.....	do.....	do.....	0
	Point Alexander, Alaska.....	do.....	do.....	do.....	0
	Point Augusta, Alaska.....	do.....	do.....	do.....	0
	Point Gambier, Alaska.....	do.....	do.....	do.....	0
	Point McCartney, Alaska.....	Dec., 1915	do.....	do.....	0
	Point St. Albans, Alaska.....	Nov., 1915	do.....	do.....	0
	Popof Reef Float, 1, Alaska.....	July, 1915	do.....	do.....	0
	Race Point, Alaska.....	Aug., 1915	do.....	do.....	0
	Rosa Reef, Alaska.....	Sept., 1915	do.....	do.....	0
	Rose Inlet, Alaska.....	July, 1915	Minor.....	Oil wick.....	1
	Sheep Creek, Alaska.....	Oct., 1915	Lens lantern.	Acetylene....	0
	Spruce Cape, Alaska.....	July, 1915	do.....	do.....	0
	Tenakee Inlet, Alaska.....	Sept., 1915	do.....	Oil wick.....	0
17th.....	Apple Cove Point, Wash.....	Oct., 1915	do.....	Acetylene....	0
	Cape Horn, Oreg.....	do.....	Minor.....	Oil wick.....	0
	Catching, Oreg.....	Sept., 1915	do.....	do.....	1
	Coalbank, Oreg.....	do.....	do.....	Electric.....	0
	Coos River, Oreg.....	do.....	do.....	Oil wick.....	0
	Fashion Reef, Oreg.....	do.....	do.....	do.....	0
	Flavel Ranges, Oreg. (4 lights).....	Oct., 1915	do.....	{Oil wick (2) } {Electricity (2) }	0
	Hamblock, Oreg.....	Sept., 1915	do.....	Oil wick.....	1
	Iceberg Point, Wash.....	Oct., 1915	Lens lantern.	Acetylene....	0
	Mailboat Slough, Wash.....	Nov., 1915	Minor.....	Oil wick.....	0
	Oak Bay, Wash.....	Aug., 1915	do.....	do.....	0
	Port Townsend Canal Range, Wash. (2 lights).	do.....	do.....	do.....	0
	Siuslaw River, Oreg.....	Nov., 1915	do.....	do.....	0
	Table Rock, Oreg.....	Oct., 1915	do.....	do.....	0
	Tansy Point Range, Wash. (2 lights).....	do.....	do.....	do.....	0
	Washougal Reef, Oreg.....	do.....	do.....	do.....	0
	Waterman Point, Wash.....	do.....	do.....	Acetylene....	0
18th.....	Redwood Creek Entrance, Cal.....	do.....	Lens lantern.	Oil wick.....	0
19th.....	Hanamanioa Point, Hawaii.....	June, 1916	do.....	Acetylene....	0
	Kipahulu, Hawaii.....	do.....	do.....	do.....	0
	Kukii Point, Hawaii.....	do.....	do.....	do.....	0

GAS BUOYS ESTABLISHED AND DISCONTINUED DURING THE FISCAL YEAR 1915.

District.	Location.	District.	Location.
	ESTABLISHED (54).		ESTABLISHED—continued.
1st.....	Goat Island Ledge, Me.	9th.....	Point Arenas, 1, P. R.
2d.....	Alma E. A. Holmes Wreck, Mass.	11th.....	Au Sable Point, 5A (bell), Mich.
	Annie E. Perry Wreck, Mass.		Poe Reef, 12 (bell), Mich.
	Bumkin Island, 1, Mass.		Round Island, 9, Mich.
	Canal Approach Breakwater (bell), Mass.	12th.....	Stag Island Lower, 5, Mich.
	Canal Breakwater, 2, Mass.		Iowa Wreck, Ill.
	Cataumet, 2, Mass.		Waukegan Shoals, 3 (bell), Ill.
	Cleveland Ledge, 7, Mass.	17th.....	Alden Bank (bell), Wash.
	George P. Hudson Wreck (bell), Mass.		Hein Bank (bell), Wash.
	Round Rock Shoal, 2, Mass.	18th.....	South Channel (whistle), Oreg.
3d.....	Barge Wreck, R. I.		Commission Rock, 4, Cal.
	Cornfield (whistle), Conn.		Invincible Rock, 4, Cal.
	Luther C. Ward Wreck, N. Y.		DISCONTINUED (20).
	Mudscow Wreck, N. Y.	2d.....	Alma E. A. Holmes Wreck, Mass.
	New Jersey Wreck (bell), N. Y.		Annie E. Perry Wreck, Mass.
4th.....	Patience Island, 2½ (bell), R. I.		Sandwich Breakwater, 2 (bell), Mass.
	Chester Range, 2C, N. J.		Tenpound Island Ledge, 6A, Mass.
	Dunlo Wreck (bell), Del.	3d.....	Barge Wreck, R. I.
	Listons Range, 2L, Del.		Charlemagne Tower Jr. Wreck, N. J.
5th.....	Brewerton Channel, 7B, 8B, Md. (2).		Coal Barge Wreck, N. J.
	Cape Henry, 2 (whistle), Va.		Luther C. Ward Wreck, N. Y.
	Claiborne Cut, 1 (bell), Md.		Mudscow Wreck, N. Y.
	Cutoff Channel, 14K, Md.		New Jersey Wreck (bell), N. Y.
	Elizabeth Palmer Wreck, Del.		Patience Island, 2½, R. I.
	Fort McHenry Channel, 1M, Md.		Teaser Wreck, N. J.
	James H. Hargrave Wreck, Va.	4th.....	Dunlo Wreck (bell), Del.
	Mary S. Ewing Wreck, Md.		Listons Range (bell), Del.
	Target Range, 5A, Md.	5th.....	Elizabeth Palmer Wreck, Del.
	Washingtonian Wreck, Del.		James H. Hargrave Wreck, Va.
	Wimble Shoal, 6 (whistle), N. C.		Mary S. Ewing Wreck, Md.
6th.....	Fernandina, 2, Fla.	6th.....	Frederick W. Day Wreck (bell), S. C.
	Frederick W. Day Wreck (bell), S. C.		Frying-Pan Shoals, 2A, FP (bell), N. C.
	Frying-Pan Shoals, 2A, FP (whistle and submarine bell), N. C.	10th.....	Buffalo Light Vessel Station, N. Y.
7th.....	Charlotte Harbor Entrance (bell), Fla.		Conneaut West Breakwater, 2, Ohio.
	Glama Wreck (whistle), Fla.		W. C. Richardson Wreck, N. Y.
	Mullet Key, Fla.	11th.....	Chas. S. Price Wreck, Mich.
	New Ground Rocks, 12 (whistle), Fla.		Livingstone Channel, 16, 18A, Mich. (2).
	North Channel (bell), Fla.	12th.....	Poe Reef, 12 (bell), Mich.
	Smith Shoal, 14 (whistle), Fla.		Waukegan Shoals, 3, Ill.
8th.....	Aransas Pass (whistle), Tex.	17th.....	Clatsop Spit, 12 (bell), Oreg.
	Theodore Weems Wreck (whistle), La.	18th.....	Commission Rock, 4, Cal.

FOG SIGNALS ESTABLISHED, IMPROVED, AND DISCONTINUED DURING THE FISCAL YEAR 1915.

District.	Location.	Character.	
ESTABLISHED (8).			
2d.....	Gallups Island, Mass.....	Bell operated electrically.	
5th.....	Fort McHenry, Md.....	Bell operated electrically.	
6th.....	Volusia Bar, Fla.....	Bell struck by machinery.	
10th.....	Buffalo Light Vessel, No. 98, N. Y.....	1st-class air siren.	
	Buffalo South Pier, N. Y.....	Bell struck by machinery.	
18th.....	Inner Harbor, Los Angeles, Cal.....	Bell struck by machinery.	
	Point Blunt, Cal.....	Electric siren.	
	Point Stuart, Cal.....	Electric siren.	
IMPROVED (14).		From—	To—
2d.....	Boston Light Vessel, No. 54, Mass.....	10-inch air whistle.	1st-class air siren.
	Hedge Fence Light Vessel, No. 41, Mass.....	10-inch steam whistle.	1st-class air siren.
3d.....	Stratford Shoal, Conn.....	3d-class reed horn.	1st-class air siren.
5th.....	Thimble Shoal, Va.....	Bell struck by machinery.	3d-class reed horn.
	Lazaretto Point, Md.....	Bell struck by machinery.	Bell operated electrically.
6th.....	Martins Industry Light Vessel, No. 1, S. C.....	12-inch steam whistle.	1st-class air siren.
10th.....	Buffalo, N. Y.....	10-inch steam whistle.	Air diaphone.
11th.....	Manitou, Mich.....	10-inch steam whistle.	1st-class air siren.
	Poe Reef Light Vessel, No. 96, Mich.....	6-inch steam whistle.	1st-class air siren.
	Stannard Rock, Mich.....	10-inch steam whistle.	Electric siren.
17th.....	Whatecom Waterway, Wash.....	Electric horn.	Electric siren.
18th.....	Fort Point, Cal.....	Air siren.	Air diaphone.
	Point Reyes, Cal.....	Air siren.	Air diaphone.
	San Luis Obispo, Cal.....	10-inch steam whistle.	1st-class air siren.

FOG SIGNALS WHICH WILL PROBABLY BE ESTABLISHED DURING THE FISCAL YEAR 1916.

District.	Location.	Character.
2d.....	Windmill Point, Mass.....	Bell operated by electricity.
3d.....	Rondout, N. Y.....	Bell struck by machinery.
7th.....	Egmont Key, Fla.....	Do.
10th.....	Ashtabula West Breakwater Pierhead, Ohio.....	Diaphone.
	Cleveland East Entrance, Ohio.....	Sireno.
	Cleveland West Pierhead, Ohio.....	Diaphone.
11th.....	Ashland Breakwater, Wis.....	Sireno.
	Eagle River Shoals, Mich.....	Do.
12th.....	Manistique East Breakwater, Mich.....	Diaphone.
17th.....	Point Hudson, Wash.....	Bell operated by electricity.
18th.....	San Antonio Creek, Cal.....	Siren (electric).

SUBMARINE SIGNALS ESTABLISHED AND DISCONTINUED DURING THE FISCAL YEAR 1915.

District.	Location.	District.	Location.
ESTABLISHED (4).		11th.....	Martin Reef Light Vessel, No. 89, Mich.
5th.....	Chesapeake Bay Entrance Gas, Whistling, and Submarine Bell Buoy, 2CB, Va. (operated by action of sea).	DISCONTINUED (2).	
6th.....	Frying-Pan Shoals Gas, Whistling, and Submarine Bell Buoy, 2A, FP, N. C. (operated by action of sea).	2d.....	Hedge Fence Light Vessel, No. 41, Mass.
8th.....	South Pass Gas, Whistling, and Submarine Bell Buoy, La. (operated by action of sea).	11th.....	Bar Point Shoal Light Vessel, No. 62, Mich.

SUBMARINE SIGNALS IN COMMISSION ON JUNE 30, 1915.

[Unless otherwise stated, these signals are operated by compressed air (50 signals).]

District.	Location.	District.	Location.
1st.....	Manana Island Gas, Whistling, and Submarine Bell Buoy, 14M, Me. (operated by action of sea).	6th.....	Brunswick Light Vessel No. 84, Ga. Frying-Pan Shoals Gas, Whistling, and Submarine Bell Buoy, 2A, FP, N. C. (operated by action of sea).
2d.....	Portland Light Vessel No. 74, Me. Boston Light Vessel No. 54, Mass. Great Round Shoal Light Vessel No. 86, Mass. Nantucket Shoals Light Vessel No. 85, Mass. Peaked Hill Submarine Bell Buoy, 2A, Mass. (operated by action of sea).		Frying-Pan Shoals Light Vessel No. 94, N. C. Martins Industry Light Vessel No. 1, S. C. St. Johns Gas, Whistling, and Submarine Bell Buoy, St. J., Fla. (operated by action of sea).
	Pollock Rip Light Vessel No. 47, Mass. Pollock Rip Blue Light Vessel No. 73, Mass. Vineyard Sound Light Vessel No. 41, Mass.	8th.....	Heald Bank Light Vessel No. 81, Tex. South Pass Entrance Gas, Whistling, and Submarine Bell Buoy, La. (operated by action of sea). Southwest Pass Light Vessel No. 43, La.
3d.....	Ambrose Channel Light Vessel No. 87, N. Y. Barnegat Shoal Gas, Whistling, and Submarine Bell Buoy, 7B, N. J. (operated by action of sea.) Brenton Reef Light Vessel No. 39, R. I. Cornfield Point Light Vessel No. 48, Conn. Fire Island Light Vessel No. 68, N. Y. Five-Fathom Bank Light Vessel No. 79, N. J. Northeast End Light Vessel No. 44, N. J. Overfalls Light Vessel No. 69, Del. Point Judith Gas, Whistling, and Submarine Bell Buoy, 2, R. I. (operated by action of sea).	11th.....	Detour Light Station, Mich. (operated electrically from the shore). Lake Huron Light Vessel No. 61, Mich. Martin Reef Light Vessel, No. 89, Mich. Poe Reef Light Vessel No. 96, Mich. Whitefish Point Light Station, Mich. (operated electrically from the shore).
5th.....	Cape Charles Light Vessel No. 49, Va. Cape Lookout Shoals Light Vessel No. 80, N. C. Chesapeake Bay Entrance Gas, Whistling, and Submarine Bell Buoy, 2CB, Va. (operated by action of sea.) Diamond Shoal Light Vessel No. 71, N. C. Fenwick Island Shoal Light Vessel No. 52, Del. Tail of the Horseshoe Light Vessel No. 46, Va. 35-Foot Channel Light Vessel No. 45, Va. Winter-Quarter Shoal Light Vessel No. 91, Va.	12th.....	Eleven-Foot Shoal Light Vessel No. 60 Mich. Grays Reef Light Vessel No. 57, Mich. Lansing Shoal Light Vessel No. 55, Mich. North Manitou Shoal Light Vessel No. 56, Mich. White Shoal Light Station, Mich. (operated electrically from lighthouse).
		17th.....	Columbia River Light Vessel No. 88, Ore. Orford Reef Gas, Whistling, and Submarine Bell Buoy, 2 OR, Ore. (operated by action of sea). Swiftsure Bank Light Vessel No. 93, Wash. Umatilla Reef Light Vessel No. 67, Wash.
		18th.....	Blunts Reef Light Vessel No. 83, Cal. San Francisco Light Vessel No. 70, Cal.

PRIVATE AIDS TO NAVIGATION MAINTAINED ON JUNE 30, 1915.

[Under the act of June 20, 1906.]

District.	Lights.	Buoys.		Other un-lighted aids.	Fog signals.	Total.
		Lighted.	Unlighted.			
1st.....			34	3		87
2d.....	34	5	27	13	1	80
3d.....	50	1	53	1	2	87
5th.....	15	4	41	50	5	122
6th.....			1	19		20
7th.....	1			20		21
8th.....	12		17	13		42
9th.....			1			1
10th.....	23	1	7		3	34
11th.....	8	6	54	1		79
12th.....	44	2	9		6	61
13th.....		1				1
16th.....	2		1	5		6
17th.....	7		12		1	20
18th.....	17	2			9	28
19th.....	18	1	2	2		23
Total.....	211	23	209	134	25	662

BRIDGES OVER NAVIGABLE WATERS LIGHTED ON JUNE 30, 1915.

[Under the act of Aug. 7, 1882, 22 Stat., 309.]

District.	Lighted bridges.	District.	Lighted bridges.	District.	Lighted bridges.
1st.....	14	8th.....	254	15th.....	7
2d.....	33	9th.....		16th.....	
3d.....	124	10th.....	59	17th.....	50
4th.....	14	11th.....	53	18th.....	8
5th.....	35	12th.....	214	19th.....	
6th.....	52	13th.....	76		
7th.....	14	14th.....	176	Total.....	1,183

AIDS MAINTAINED UNDER CONTRACT DURING THE FISCAL YEAR 1915.

District.	Name of aids.	Annual cost.
5th.....	Currituck Sound, N. C. (130 stakes).....	\$107.25
	Sand Shoal Inlet, Fishermans Inlet, and Magothy Bay, Va. (2 buoys and 22 stakes).....	140.00
6th.....	Little River Inlet, N. C. (4 bar buoys).....	1.00
10th.....	Lake Ontario and the St. Lawrence River, N. Y. (36 buoys).....	1,900.00
	Niagara River, N. Y. (50 buoys).....	964.50
11th.....	Superior Bay, St. Louis Bay and River, Wis. and Minn. (30 lights).....	1,800.00
12th.....	Fox River, Wis. (14 spar buoys); Green Bay, Wis. (18 spar buoys).....	160.00
16th.....	Cooks Inlet, Alaska (3 lights).....	170.00
	St. Michael Canal and Apoon Pass, Alaska (32 buoys).....	338.50
	Norton Sound (11 lights).....	662.50
	Orizaba Reef Bell Buoy.....	30.00
18th.....	Hookton Channel Range Rear Light, Cal.....	1.00
19th.....	Lahaina Buoy Light, Hawaii.....	1.00

LIGHT VESSELS IN COMMISSION DURING THE FISCAL YEAR 1915.

Number.	Station.	District.	Tonnage.		When built.	Material of hull.	Dimensions.			Indicated horsepower (self-propelling).	Regular complement.		Fog signal.	Illuminant.	Cost of repairs made during fiscal year.	Cost of maintenance during fiscal year.	Original cost.	On station.	
			Gross.	Net.			Length over all.	Breadth.	Depth.		Officers.	Crew.						Months.	Days.
74	Portland, Me.	1	a 495		1902	Wood.	Fl. in. 129 9	Fl. in. 28 6	Fl. in. 13 0	380	4	8	12" steam whistle b.	Acet.	\$4,278	\$10,641	\$88,896	8	3
3	Shovelful Shoal, Mass.	2	140		1852	do.	c 69 4	23 0	10 0		2	5	Bell or horn.	Oil.	273	4,618	12,000	12	...
4	Handkerchief, Mass.	2	104		1855	do.	c 77 0	20 0	10 0		2	5	do.	do.	829	4,998		12	...
5	Cross Rip, Mass.	2	104		1864	do.	c 80 6	21 6	9 0		2	6	8" air whistle.	do.	581	6,234		12	...
6	Relief.	2	120			do.	c 80 0	24 0	10 0		1		Bell.	do.	2,016	1,821		2	29
9	Hedge Fence, Mass.	2	104		1857	do.	c 81 2	28 2	9 6		2	5	8" air whistle.	do.	2,718	3,044	19,883	9	7
41	Vineyard Sound, Mass.	2	387		1876	do.	120 6	26 9	11 0		2	6	First-class air siren b.	do.	5,216	6,285	33,000	11	25
42	Hen and Chickens, Mass.	2	410		1877	do.	121 7	26 6	10 6		3	7	10" air whistle.	do.	5,614	10,439	40,796	8	11
47	Pollock Rip, Mass.	2	a 470		1891	Comp.	120 10	26 6	11 0		4	6	12" steam chime wh. b.	do.	8,835	8,879	60,000	9	...
54	Boston, Mass.	2	310		1892	Steel.	118 10	26 0	11 0	150	4	7	First-class air siren b.	Inc. o. v.	41,659	9,565	62,030	...	3
66	Relief d.	2	a 590		1896	Comp.	123 0	28 6	13 0	350	4	7	12" steam chime wh. b.	Oil or o.	32	7,816	66,282	10	28
73	Pollock Rip Shoal, Mass.	2	a 538		1901	Steel.	123 9	28 6	12 9	400	4	8	do. b.	Oil.	1,048	10,395	79,872	11	9
85	Nantucket Shoals, Mass. d.	2	a 683	246	1907	do.	135 5	29 0	13 0	380	5	10	12" steam whistle b.	El. inc.	4,248	15,462	99,000	9	12
86	Great Round Shoal, Mass.	2	a 683	246	1907	do.	135 5	29 0	13 0	380	4	8	do. b.	Oil.	278	11,015	99,000	12	...
90	Relief.	2	a 685	225	1908	do.	135 5	29 6	13 0	400	2	6	12" steam chime wh. b.	do.	982	10,729	107,213	10	26
11	Scotland, N. J.	3	320		1853	Wood.	c 104 0	24 8	11 6		2	6	Bell.	Oil gas.	1,238	5,663	13,462	10	3
13	Bartlett Reef, Conn.	3	155		1854	do.	c 79 8	21 8	10 4		2	5	do.	Oil.	1,539	4,741	12,000	9	15
16	Relief.	3	250		1854	do.	c 103 6	22 6	11 0		0	1	First-class air siren, 6" whistle. b.	do.	1,864	1,202	28,084	5	6
20	do.	3	165		1867	do.	c 81 6	21 6	10 0		0	1	Bell.	do.		822	25,040	1	28
23	Ram Island Reef, N. Y.	3	186		1857	do.	c 94 2	24 0	9 0		2	5	do.	do.	168	484	7,500	10	3
39	Brenton Reef, R. I.	3	387		1875	do.	119 6	26 9	13 0		4	7	12" and 6" steam wh. b.	do.	46	8,711	42,200	12	...
44	Northeast End, N. J.	3	197		1882	Iron.	115 6	25 0	10 6		4	6	First-class steam siren b.	Acet.	1,441	9,279	50,000	10	24
48	Cornfield Point, Conn.	3	a 470		1891	Comp.	120 10	27 8	12 0		3	7	First-class air siren b.	do.	569	8,290	52,780	11	9
51	Relief.	3	283		1892	Steel.	118 10	26 9	11 0	135	2	5	12" steam whistle b.	El. inc.	3,284	8,252	53,325	5	25
68	Fire Island, N. Y.	3	a 590	204	1897	Comp.	122 10	28 6	12 6	350	4	10	12" steam chime wh. b.	do.	1,801	12,714	74,750	9	29
69	Overfalls, Del.	3	a 590	204	1897	do.	122 10	28 6	13 0	350	4	10	do. b.	do.	1,143	12,789	79,500	9	28
79	Five-Fathom Bank, N. J.	3	a 678	188	1904	Steel.	129 0	28 6	12 6	325	4	8	do. b.	Oil.	328	10,725	89,000	11	22
87	Ambrose Channel, N. Y.	3	a 683	246	1907	do.	135 5	29 0	13 0	325	4	10	12" steam whistle b.	El. arc.	1,597	13,000	99,000	10	8
78	Relief.	3	a 668	188	1904	do.	129 0	28 6	12 6	325	2	5	do. b.	Oil.	6,261	7,179	89,030	7	11

Relief.	5	210	1849	Wood	98	0	25	0	9	0	1	2	Bell.	112	2,577	12,402	4	20
Thirty-five Foot Channel, Va.	5	a 401	1887	Steel	124	6	27	0	12	0	2	6	8" air chime whistle b.	4,298	5,098	58,500	7	10
Tail of the Horseshoe, Va.	5	a 401	1887	do.	124	6	27	6	12	0	4	6	12" steam whistle b.	2,033	8,676	60,000	12	.....
Cape Charles, Va.	5	a 470	1890	Comp.	120	10	27	0	14	0	4	6	do. b.	2,398	8,224	57,900	12	.....
Fenwick Island Shoal, Del.	5	a 416	1892	Steel	118	10	26	6	12	0	4	8	First-class air siren b.	11,384	8,398	62,000	4	.....
Diamond Shoal, N. C.	5	a 590	1897	Comp.	122	10	28	6	13	0	5	10	12" steam chime wh. b.	924	12,472	70,700	9	17
Relief	5	a 693	1900	Steel	123	6	28	6	14	0	2	6	do. b.	301	10,850	89,000	9	22
Cape Lookout Shoals, N. C.	5	a 668	1894	do.	120	0	28	6	12	6	4	9	do. b.	5,047	11,531	85,000	9	13
Winter-Quarter Shoals, Va.	5	a 685	1908	do.	135	5	29	0	13	0	4	8	8" steam chime wh. b.	4,870	9,583	107,213	9	13
Bush Bluff, Va.	5	87	1876	Comp.	80	6	19	5	12	0	1	2	Bell.	23	1,602	.....	9	1
Relief	5	232	1904	Wood	101	0	23	6	10	6	1	2	do.	.....	2,054	.....	2	29
Martins Industry, S. C.	6	275	1905	do.	103	0	24	0	13	0	2	8	12" steam whistle b.	9,414	7,960	.....	9	28
Charleston, S. C.	6	150	1884	do.	101	10	23	0	10	0	2	6	8" air chime whistle	69	5,789	48,000	9	22
Relief	6	310	1892	Steel	119	0	26	6	11	0	3	5	12" steam whistle b.	1,499	8,052	61,538	6	21
Brunswick, Ga.	6	a 583	1907	do.	135	5	29	0	13	0	4	8	do. b.	1,942	11,039	99,000	10	17
Frying Pan Shoals, N. C.	6	a 670	1911	do.	135	6	29	0	13	0	4	10	12" steam chime wh. b.	1,904	12,402	104,604	11	2
Southwest Pass, La.	8	191	1881	Comp.	118	0	25	0	12	0	4	6	12" steam whistle b.	3,506	7,705	50,000	6	13
Heald Bank, Tex.	8	a 685	1904	Steel	129	0	28	6	12	6	4	8	do. b.	2,022	10,500	90,000	7	17
Buffalo, N. Y.	10	f 195	1915	do.	101	0	23	6	11	5	4	2	First-class air siren	17	2,697	87,025	.....	19
Lake Huron, Mich.	11	105	1893	Wood	87	2	21	0	9	0	3	3	6" steam whistle b.	225	4,410	14,098	7	21
Bar Point Shoal, Mich.	11	105	1893	do.	87	2	21	6	8	0	3	3	do. b.	533	4,507	14,098	7	22
Lake St. Clair, Mich.	11	160	1902	Steel	83	9	24	0	4	9	2	2	Bell.	245	2,971	14,983	7	23
Martin Reef, Mich.	11	f 205	1905	do.	88	3	21	0	10	0	4	2	6" steam whistle	383	5,559	37,500	7	11
Poe Reef, Mich.	11	f 170	1914	do.	101	0	23	6	11	5	3	3	First-class air siren b.	360	4,027	71,292	2	.....
Lansing Shoal, Mich.	12	129	1891	Wood	102	8	20	0	9	0	4	2	6" steam whistle b.	2,686	5,350	13,600	7	20
North Manitowish Shoal, Mich.	12	130	1891	do.	102	8	20	0	8	10	4	2	do. b.	3,915	5,796	13,600	7	19
Grays Reef, Mich.	12	150	1891	do.	102	8	20	0	8	10	4	2	do. b.	2,824	5,295	13,600	7	19
Eleven-Foot Shoal, Mich.	12	105	1893	do.	87	2	21	6	8	6	3	3	do. b.	1,637	5,014	13,900	7	16
Peshigo Reef, Wis.	12	f 155	1906	Steel	75	0	21	6	4	0	2	3	8" air chime whistle	14	3,655	13,950	7	4
Milwaukee, Wis.	12	f 368	1912	do.	108	5	23	0	10	2	4	5	12" steam whistle	577	8,263	74,558	10	9
Umatilla Reef, Wash.	17	450	1897	Comp.	122	7	28	6	13	0	4	10	12" steam chime wh. b.	20,305	1,282	69,750	4	19
Columbia River, Oreg.	17	a 683	1907	Steel	135	5	29	0	13	0	4	10	12" steam whistle b.	1,593	14,489	99,000	11	14
Relief	17	a 685	1908	do.	135	5	29	0	13	0	2	5	do. b.	.....	15,839	107,213	10	1
Swifsure Bank, Wash.	17	a 685	1908	do.	135	5	29	0	13	0	4	11	do. b.	2,326	15,172	107,213	9	29
San Francisco, Cal.	18	a 590	1897	Comp.	122	10	28	6	13	0	4	11	do. b.	2,232	15,987	79,000	8	2
Relief	18	a 578	1904	Steel	129	6	28	8	12	0	2	5	do. b.	207	13,659	90,000	7	26
Blunt's Reef, Cal.	18	a 668	1904	do.	129	0	28	6	13	0	4	10	do. b.	4,601	13,278	90,000	8	15

^e Wood sheathed.
^f Displacement (fresh water).

^c Length between perpendiculars.
^d Equipped with radio.

^a Displacement (salt water).
^b Submarine signal.

TENDERS OF THE LIGHTHOUSE SERVICE IN COMMISSION DURING THE FISCAL YEAR 1915.

Name.	District.	Displacement.		Description.	Material of hull.	Dimensions.				Mean draft.		Indicated horsepower.	Regular complement.		Miles steamed.	Coal consumed for all purposes.	Cost of repairs.	Cost of maintenance.	Original cost.
		Light.	Loaded.			Length over all.	Breadth.	Depth.	Light.	Loaded.	Officers.		Crew.						
<i>Irbiscus</i>	1	Tons. 803	Tons. 1,053	Steamer, screw.....	Steel..	Feet. 190	Feet. 30	Feet. 16	Feet. 10	Feet. 13	0	1,000	6	23	13,366	Tons. 1,762	\$1,848	\$35,301	\$184,643
<i>Zizania</i>	1	575	643	do.....	do..	161	27	12	8	9	6	650	6	19	9,240	1,363	4,021	29,851	48,739
<i>Lilac</i>	1	461	643	do.....	do..	155	27	15	10	0	3	800	5	19	12,259	1,223	2,305	29,826	92,125
<i>Annona</i>	2	803	1,053	do.....	do..	190	30	16	10	10	0	1,000	7	23	14,114	2,127	2,149	37,435	191,999
<i>Azalea</i>	2	330	516	do.....	do..	154	25	12	6	9	0	400	5	19	11,514	833	1,487	26,717	79,792
<i>Mayflower</i>	2	593	668	do.....	do..	164	30	12	7	4	1	650	5	22	9,471	1,357	9,325	29,919	74,872
<i>Daisy</i>	3	61	84	do.....	Wood.	80	14	5	4	0	5	60	2	4	9,100	153	310	7,046	6,500
<i>Garofania</i>	3	217	245	do.....	do..	117	20	9	6	0	8	200	4	11	8,728	488	1,003	15,948	11,000
<i>John Rodgers</i>	3	455	571	Steamer, side-wheel.....	Iron..	160	27	9	6	6	7	260	4	16	7,268	734	1,669	20,859	59,987
<i>Larkspur</i>	3	738	888	Steamer, screw.....	Steel..	169	30	14	9	1	10	750	6	22	13,687	2,120	1,086	30,940	123,259
<i>Mistletoe</i>	3	455	476	Steamer, side-wheel.....	Wood.	160	26	9	6	9	7	370	4	16	7,692	692	1,545	18,868	45,833
<i>Pansy</i>	3	431	454	Steamer, screw.....	Iron..	152	25	11	7	7	11	250	4	17	18	62	10,787	14,085	48,739
<i>Tulip</i>	3	803	1,053	do.....	Steel..	190	30	16	10	10	0	1,000	7	24	16,483	2,216	4,020	36,526	191,658
<i>Iris</i>	4	519	606	do.....	do..	153	30	10	8	7	9	800	4	19	11,873	1,367	3,094	26,202	84,407
<i>Woodbine</i>	4	85	107	Oil, screw.....	Wood.	95	16	7	5	2	5	125	2	4	11,654	418	1,889	8,502	24,728
<i>Holly</i>	5	431	499	Steamer, side-wheel.....	Comp.	176	24	10	7	0	8	400	4	16	9,955	732	1,075	20,667	41,911
<i>Ivy</i>	5	736	916	Steamer, screw.....	Steel..	173	30	13	7	11	9	700	5	22	10,419	1,833	6,540	30,414	123,660
<i>Jessamine</i>	5	369	427	Steamer, side-wheel.....	Iron..	156	24	10	7	3	8	300	4	16	8,062	753	3,363	20,130	41,911
<i>Juniper</i>	5	125	146	Steamer, screw.....	Steel..	95	18	8	4	6	5	290	2	8	11,305	578	563	9,238	29,425
<i>Laurel</i>	5	218	233	do.....	Wood.	105	22	9	6	1	6	160	4	8	385	9	115	2,762	56,502
<i>Maple</i>	5	567	709	do.....	Steel..	164	30	12	7	3	9	650	6	22	13,397	1,333	3,106	29,625	93,889
<i>Orchid</i>	5	803	1,053	do.....	do..	190	30	16	10	10	0	1,000	6	23	14,373	1,760	1,199	31,858	186,151
<i>Cypress</i>	6	803	1,053	do.....	do..	190	30	16	10	10	0	1,000	7	23	20,285	2,605	4,069	38,238	191,633
<i>Mangrove</i>	6	593	668	do.....	do..	164	30	12	7	4	8	550	6	22	14,170	1,554	4,714	32,988	74,998
<i>Snowdrop</i>	6	30	41	Gasoline, screw.....	Wood.	69	11	5	2	11	3	32	2	2	9,281	26,255	943	5,215	9,700
<i>Water Lily</i>	6	29	39	do.....	do..	64	11	5	2	11	3	36	2	2	5,674	23,535	312	4,725	9,261
<i>Arbutus</i>	7	398	545	Steamer, screw.....	do..	153	25	11	7	1	9	360	6	19	9,550	1,087	101	29,727	49,769

	8	276	377	1911	do.	Steel..	117	24	10	5	10	7	7	280	4	12	4,999	476	1,271	18,464	57,412
Camellia.....	8	736	916	1904	do.	do.	173	30	13	7	11	9	6	700	5	22	10,872	1,518	4,962	29,142	124,874
Magnolia.....	8	728	986	1907	do.	do.	174	31	15	9	8	12	1	900	7	22	12,895	1,863	2,237	35,009	124,958
Sunflower.....	9	435	542	1872	do.	Wood..	140	25	11	9	6	11	0	225	4	17	8,177	748	242	24,886	44,500
Myrtle.....	10	/ 542	/ 836	1904	do.	Steel..	165	29	14	8	0	10	11	700	6	22	7,884	1,429	6,083	30,635	119,718
Groves.....	11	/ 597	/ 975	1892	do.	do.	166	28	14	8	6	12	6	672	5	19	10,341	1,496	4,006	30,539	74,994
Amaranth.....	11	/ 353	/ 415	1906	do.	do.	126	25	12	7	3	8	3	440	4	10	7,880	622	2,608	16,238	70,573
Aspen.....	11	/ 163	/ 205	1899	do.	Wood..	93	22	7	5	4	6	4	140	4	8	9,896	368	758	13,555	84,871
Clover.....	11	/ 477	/ 696	1890	do.	Iron...	160	27	12	8	7	11	3	550	5	19	11,823	940	671	25,071	84,871
Marigold.....	12	/ 493	/ 914	1903	do.	Steel..	165	28	14	7	0	11	6	878	5	19	10,030	1,388	3,460	26,710	115,000
Hyacinth.....	12	/ 600	/ 887	1903	do.	do.	169	30	13	8	10	11	9	700	6	22	11,638	1,612	2,748	32,393	114,992
Sumac.....	13, 14	/ 194	/ 283	1888	do.	Steamer, stern-wheel..	169	27	4	2	5	3	4	152	3	15	3,328	448	1,319	9,354	33,221
Goldenrod.....	15	/ 418	/ 494	1903	do.	do.	189	34	7	3	6	4	1	600	3	15	13,549	2,107	4,159	23,300	60,000
Oleander.....	16, 19	803	1,053	1908	do.	Steamer, screw.....	190	30	16	10	10	13	0	1,000	7	22	7,547	1,353	11,705	46,331	213,880
Kukul p.....	16	253	317	1915	do.	Wood..	112	22	10	7	3	8	6	330	4	8	.....	.....	.....	.....	62,100
Fern.....	17	631	831	1903	do.	do.	179	28	15	9	6	11	6	685	6	19	8,078	1,152	11,527	31,391	118,568
Heather.....	17	803	1,053	1908	do.	do.	190	30	16	10	10	13	0	1,000	6	23	13,087	1,909	1,941	39,419	211,817
Manzanita.....	18	654	806	1885	do.	Iron...	180	27	15	9	9	11	6	750	6	19	10,744	1,385	2,729	42,118	87,872
Madrono.....	18	803	1,053	1908	do.	Steel..	190	30	16	10	10	13	0	1,000	6	23	9,760	1,155	344	36,615	213,499
Sequoia.....	19, 16	464	643	1892	do.	do.	155	27	15	10	0	12	3	800	6	19	13,139	1,168	8,300	4,322	93,993
Columbine.....					do.	do.															

^a Light=without cargo and deck loads, and a minimum supply of stores, provisions, water, and coal.
^b Loaded=bunkers full of coal, all tanks, including trimming tanks, full of water; full stores and provisions, and an average maximum cargo and deck load.
^c Length between perpendiculars.

^d Also 9,868 gallons gasoline and 7,757 gallons kerosene.

^e Gallons gasoline.

^f Displacement (fresh water).

^g Equipped with radio.

^h Completed and placed in commission June 25, 1915.

LIGHTHOUSE VESSELS SOLD OR TRANSFERRED DURING THE FISCAL YEAR 1915.

Light vessel *No. 50*, formerly stationed off Columbia River, Oreg. and Wash., was surveyed and condemned as unserviceable and of no further use to the Service, and sold on April 27, 1915, to the highest bidder for \$1,667.99.

Light vessel *No. 59*, formerly stationed at Poe Reef, Lake Huron, Mich., was surveyed and condemned as unserviceable and of no further use to the Service, and sold on October 1, 1914, to the highest bidder for \$340.

CONSTRUCTION OF TENDERS AND LIGHT VESSELS.

Tender "Fern."—Acts of May 27, 1908, and March 4, 1909, appropriated \$200,000 for one tender (*Aster*), and the act of July 27, 1912, authorized the use of this amount for the construction of two tenders for general service. Plans and specifications covering a small tender for service in the inside waters of Alaska were issued, and on April 17, 1914, a contract was awarded for its construction to Hall Bros. Marine Railway & Shipbuilding Co., Winslow, Wash., in the sum of \$62,000. The vessel was launched February 6, 1915, completed during the fiscal year and proceeded to her station of duty on July 1, 1915. Amount expended to June 30, 1915, \$38,989.90.

Tender "Laurel."—Appropriation of March 4, 1907, \$60,000, for a tender for the fifteenth district (*Dandelion*); authority of act of July 27, 1912, to use this appropriation for a tender for general service. Plans were prepared for a small tender for work in the inside waters of the Atlantic coast, and on September 9, 1913, a contract was awarded for its construction to Spedden Ship Building Co., Baltimore, Md., in the sum of \$41,000. The vessel was completed during the fiscal year and went into commission on May 21, 1915. Amount expended to June 30, 1915, \$45,711.13.

Tender "Palmetto."—Acts of May 27, 1908, and March 4, 1909, appropriated \$200,000 for one tender (*Aster*) and the acts of July 27, 1912, and March 3, 1915, authorized the use of this amount for the construction of two or more tenders for general service. Plans were prepared for a light-draft tender for use in the inside waters of the sixth district, and on September 3, 1915, a contract was awarded to the Merrill-Stevens Co., Jacksonville, Fla., in the sum of \$28,975. No expenditures were made to June 30, 1915. The appropriation of \$30,000, made by the act of May 27, 1908, for a tender for the engineer sixth lighthouse district or elsewhere will probably be used for the purchase of a small tender for use in the third district. Expenditures for plans under this appropriation to June 30, 1915, amounted to \$2,921.40.

Tender "Pansy."—The act of March 4, 1909, appropriated \$12,000 for repairs to the lighthouse tender *Pansy*. A new boiler and extensive repairs were completed during the fiscal year. Amount expended to June 30, 1915, \$10,868.62.

Tender "Rose."—Acts of May 27, 1908, and March 4, 1909, appropriated \$200,000 for one tender (*Aster*), and the act of July 27, 1912, authorized the use of this amount for the construction of two tenders for general service. As one of these plans and specifications were completed for a tender of moderate size and draft for use in the small harbors and inside waters of the coasts of Oregon and Washington, and on November 6, 1914, a contract was awarded for its construction to Anderson Steamboat Co., Seattle, Wash., in the sum of \$87,950. Amount expended to June 30, 1915, \$1,027.24.

Tender "Cedar."—The act of January 25, 1915, appropriated \$250,000 for a lighthouse tender for general service. Plans and specifications were immediately prepared for a first-class seagoing tender, for service in Alaska, and on May 4, 1915, a contract was awarded for its construction to the Craig Shipbuilding Co., Long Beach, Cal., in the sum of \$234,500. Amount expended to June 30, 1915, \$652.80.

Light vessel "No. 96."—Appropriation of March 4, 1911, \$75,000, for a light vessel for service at or near a point between Point Abino and Sturgeon Point in Lake Erie. Plans and specifications were prepared for a nonpropelling light vessel, and contract was entered into on April 24, 1913, with the Racine-Truscott-Shell Lake Boat Co., Muskegon, Mich., for the construction of this vessel, in the sum of \$69,850. The vessel was completed during the fiscal year, and placed in service on April 24, 1915, at the opening of navigation. Amount expended to June 30, 1915, \$64,874.23.

Light vessel "No. 98."—Act of August 26, 1912, appropriated \$250,000 for light vessels for general service. As one of these, it was decided to build a duplicate of *No. 96*, the design of which was approaching completion, for service on the Lakes. Bids were received and contract was entered into on April 24, 1913, with the Racine-Truscott-Shell Lake Boat Co., Muskegon, Mich., for its construction, in the sum of \$69,850. It was subsequently decided to install an internal-combustion kerosene propelling engine; and on August 26, 1914, a contract was awarded to August Mietz, New York, for the purchase of the engine, in the sum of \$6,280, and on August 5, 1914,

a contract was awarded to the Racine-Truscott-Shell Lake Boat Co., Muskegon, Mich., for the installation, in the sum of \$5,560. The latter-named company went into the hands of a receiver prior to the completion of all the work, which was finished directly by the Lighthouse Service. On June 12, 1915, the vessel was placed in service. Amount expended to June 30, 1915, \$81,943.85

Light vessel "No. 99."—Act of August 26, 1912, appropriated \$250,000 for light vessels for general service. It is proposed to build a vessel with the available balance of the appropriation. A preliminary design has been prepared. Amount expended to June 30, 1915, \$5,144.61.

Light vessel "No. 100."—The act of August 24, 1912, appropriated \$130,000 for a light vessel for general service. It is proposed to build a large vessel that will be suitable for important exposed stations. No expenditures to June 30, 1915.

Light vessel "No. 101."—Act of August 26, 1912, appropriated \$250,000 for light vessels for general service. Plans and specifications were prepared for a second-class vessel for general relief duty on the Atlantic coast, and on March 6, 1915, a contract was awarded for its construction to the Pusey & Jones Co., of Wilmington, Del., in the sum of \$93,699. Amount expended to June 30, 1915, \$459.

Light vessel "No. 102." (Southwest Pass).—The act of October 22, 1913, appropriated \$125,000 for a light vessel for the Southwest Pass entrance to the Mississippi River, La. Plans and specifications for a vessel generally similar to *No. 101* were prepared, and on March 6, 1915, a contract was awarded for its construction to The Pusey & Jones Co., of Wilmington, Del., in the sum of \$93,699. Amount expended to June 30, 1915, \$1,635.59.

SPECIAL WORKS OF CONSTRUCTION COMPLETED (OMITTING VESSELS).

Oil houses for light stations.—The acts of May 27, 1908, March 4, 1909, and June 25, 1910, each appropriated \$10,000 for establishing isolated oil houses for the storage of kerosene, etc. During the fiscal year oil houses were completed at the following-named stations:

	Amount expended.		Amount expended.
New Haven, Conn.....	\$307.02	Stratford Shoal, N. Y.....	\$257.72
Southwest Ledge, Conn.....	438.54	Point Jiguero, P. R.....	292.14
Saugerties, N. Y.....	230.48	Honolulu Harbor, T. H.....	549.97
Whale Rock, R. I.....	164.18		

THIRD DISTRICT.

Staten Island lighthouse depot, N. Y.—The act of March 4, 1911, appropriated \$40,000 for repair and extension of wharves at the general lighthouse depot, Staten Island, N. Y. The extending of the north wharf was completed on June 5, 1913, and repairs to the south wharf was completed in June, 1915. Amount expended to June 30, 1915, \$39,976.74. (Description of work accomplished printed in annual report for 1914.)

FOURTH DISTRICT.

Brandywine Shoal, Del.—The act of March 4, 1911, appropriated \$75,000 for rebuilding and improving the present light and fog signal at Brandywine Shoal, Delaware Bay, Del., on the present or an adjacent site. The foundation of the lighthouse was launched at Lewes, Del., on July 10, 1913, and was towed to the site and placed on the pile foundation on August 6, 1913. The superstructure was completed on October 8, 1914. The project was completed on November 1, 1914, at a cost of \$74,960.34. (See p. 93.)

Miah Maull Shoal, N. J.—Appropriations were made by the acts of June 30, 1906 (\$40,000), March 4, 1907 (\$35,000), and March 4, 1911 (\$30,000), for a light and fog signal station at Miah Maull Shoal, Delaware River. The foundation shell was erected at the site and partly filled with concrete in December, 1909. The superstructure was completed on February 20, 1913, and the permanent fog signal was established on December 5, 1913. The project was completed on June 15, 1915, at a cost of \$104,102.48. (Described in annual report for 1913.)

FIFTH DISTRICT.

Thimble Shoal, Va.—The act of June 25, 1910, appropriated \$68,000, and the act of August 26, 1912, \$39,000 for the establishment of the light and fog signal station at this point. The light and fog signal were put in operation on December 1, 1914. Amount expended to June 30, 1915, \$99,952.76. (See p. 95.)

SIXTH DISTRICT.

Cape Fear River, N. C.—The act of March 4, 1911, appropriated \$21,000 and the act of August 26, 1912, appropriated \$30,000 for lights and signals in Cape Fear River below Wilmington, N. C. Thirty four-pile reinforced concrete substructures on marine sites with pipe towers and two pipe towers on concrete piers on land have been constructed. Bald Head Light has also been changed from oil burning to acetylene equipment and an auxiliary lens lantern placed in one of the marine structures as an additional aid. The light went into operation on November 11, 1913. Spare equipment was purchased and the work completed May 24, 1915. Amount expended to June 30, 1915, \$50,873.27. (Described in annual report for 1913.)

NINTH DISTRICT.

San Juan, P. R., lighthouse depot.—The act of May, 1908, appropriated \$15,000 for a storehouse and dock at San Juan, P. R., and the act of July 27, 1912, authorized the use of the unexpended balance of this appropriation for the alteration, repair, and construction of necessary buildings, docks, and improvements of the grounds of the San Juan lighthouse depot. During the fiscal year the alterations and repairs were continued and the work is completed so far as the appropriation allowed.

Amount expended to June 30, 1915, \$14,999.40.

SIXTEENTH DISTRICT.

Lincoln Rock fog-signal station.—The act of March 4, 1911, appropriated \$25,000 for rebuilding and improving the light and fog signal at Lincoln Rock, Alaska. The new station was placed in commission October 10, 1912; it was entirely completed during the past fiscal year. Total expended to June 30, 1915, \$24,774.49.

SEVENTEENTH DISTRICT.

Warrior Rock, Oreg.—The act of October 22, 1913, appropriated \$2,000 for improving Warrior Rock Light Station, Oreg., including the purchase of additional land. One and one-eighth acres, more or less, were purchased, including the dwelling and other buildings thereon, at a total cost of \$2,000.

EIGHTEENTH DISTRICT.

Point Arena Light Station, Cal.—The act of October 22, 1913, appropriated \$3,000 for the completion of the unfinished portion of the Government road from Rollerville to the Point Arena Lighthouse. The work was completed August 1, 1914. The amount expended to June 30, 1915, was \$3,000.

NINETEENTH DISTRICT.

Kilauea Point, Kauai Island, Hawaii.—The act of May 27, 1908, appropriated \$75,000 for a light and fog-signal station at some point on the northerly or westerly coast of Kauai Island, Hawaii. On May 1, 1913, the light went into operation and on June 30, 1913, work was suspended owing to exhaustion of funds. By act of August 1, 1914, \$3,000 was appropriated for the completion of this station and accordingly work was resumed on November 27, 1914, and the station completed February 2, 1915. Total cost to June 30, 1915, \$77,982.07.

Light keepers' dwelling, Barbers Point Light Station, Hawaii.—With an allotment of \$3,200 from the appropriation for light keepers' dwellings provided by act of May 27, 1908, a one-story single-frame structure with plastered interior and complete modern plumbing and water systems was erected June 26, 1915, for the keeper at Barbers Point, Hawaii. Total cost to June 30, 1915, \$3,198.96. (See p. 94.)

SPECIAL WORKS OF CONSTRUCTION UNCOMPLETED (OMITTING VESSELS).

SECOND DISTRICT.

Cape Cod Canal Lights, Mass.—Appropriation of \$50,000 was made by the act of August 1, 1914. Twelve acetylene-lighted pile dolphins, in Buzzards Bay, and an electric light on iron tower, in temporary location on breakwater at Sandwich, Cape Cod Bay, were established. Upon completion of breakwater, tower will be moved to

permanent location on end of same, and electrically operated fog bell will be operated from same, as well as light. One gas-lighted buoy on Cleveland Ledge, Buzzards Bay, was established. Gas buoy on Negro Ledge, and three gas and one gas and bell buoy at entrance to dredged channel, Buzzards Bay approach, will be established, and light and fog signal at Wings Neck will be improved during fiscal year 1916. Probable date of completion will depend upon delivery of apparatus and completion of breakwater. Amount expended to June 30, 1915, \$41,658.85.

THIRD DISTRICT.

Staten Island, N. Y., and West Bank, N. J.—The acts of June 30, 1906, and March 4, 1909, each appropriated \$50,000 for a lighthouse on Staten Island, N. Y., and the raising of West Bank Light, N. J. This act of June 30, 1906, also appropriated \$10,000 for a temporary structure to maintain West Bank Light while being raised, and a temporary structure for North Hook Light while being moved. All work except installing lightning rod at Staten Island Light has been completed, and the new light was put into operation on April 15, 1912. It is expected that all work will be completed about July 30, 1915. Amount expended to June 30, 1915, \$73,926.03.

Stonington, Conn.—The act of March 4, 1911, appropriated \$500 for the repair of the sea wall at Stonington Point, Conn. It is expected that the work will be completed about November 15, 1915. Amount expended to June 30, 1915, \$7.73.

Staten Island lighthouse depot, N. Y.—The act of March 4, 1911, appropriated \$30,000 for constructing a power house and foundry, and for completing the equipment, wiring, etc., of the power plant at the general lighthouse depot, Staten Island, N. Y. The power house, foundry building, and the installation of the machinery were all completed with the exception of part of the floors in the power house and the installation of the machinery in the foundry. It is expected that all work will be completed about November 1, 1915. Amount expended to June 30, 1915, \$29,455.29. The act of August 1, 1914, appropriated \$23,000 for the erection of a new carpenter shop at the general lighthouse depot, Staten Island, N. Y. The plans and specifications for this building have been prepared and proposals invited. It is expected to have all work completed about June 1, 1916. No expenditures have been made from this appropriation.

Point Judith Breakwater, R. I.—The act of March 4, 1909, appropriated \$12,000 for establishing lights and fog signals on the breakwater of the Harbor of Refuge, Point Judith, R. I. Four lights were completed and went into commission on October 22, 1912. The erection of one more light is in progress, and it is expected will be completed about July 10, 1915. The structures consist of hollow cast-iron columns with a tank house around the top for holding the acetylene gas tanks. The total cost to June 30, 1915, was \$11,387.36.

Rondout Creek, Hudson River, N. Y.—The act of March 4, 1911, appropriated \$40,000 for establishing a light and fog signal station at or near the mouth of Rondout Creek, Hudson River, N. Y. The work was started in March, 1914, and it is expected will be completed about September 15, 1915. Amount expended to June 30, 1915, \$21,590.75.

Hunts Point, N. Y.—The act of March 4, 1911, appropriated \$5,000 for the establishment of a light and fog signal to mark Hunts Point, between Hell Gate and Whitestone Point, East River, N. Y. Steps have been taken for procuring a site for this light station from the State of New York. The matter is held in abeyance pending the determination of the extent of development of bulkheads and docks to be built at this point. The date of completion is indefinite. No expenditure has been made from this appropriation.

FOURTH DISTRICT.

Joe Flogger Shoal, Del.—The act of June 20, 1906, authorized \$75,000 for establishing a light and fog signal at or near this shoal. The act of June 30, 1906, appropriated \$40,000 for this purpose, and the act of June 17, 1910, increased the limit of cost for this light and fog signal to \$105,000. An additional appropriation has not yet been made. Work on this project has been deferred, as the total amount necessary has not been appropriated and other projects are considered of greater importance. The shoal is now marked by a gas buoy. Amount expended to June 30, 1915, \$603.21.

FIFTH DISTRICT.

Norfolk Harbor, Va.—The act of March 4, 1911, appropriated \$35,000 for establishing an adequate system of lighting in the channel leading to Norfolk Harbor, Va. Work under the appropriation is still in progress. During the year orders have been placed to purchase six acetylene buoys for use at some of the more important points. Amount expended to June 30, 1915, \$31,393.66.

Fort McHenry Channel, Md.—The act of March 4, 1911, appropriated \$125,000 for range lights in the Fort McHenry Channel, Md. Authority was given by Congress on July 27, 1912, for the use of this appropriation for the establishment of gas buoys and other aids to navigation in the channels leading to Baltimore, Md. During the year four gas buoys, 24 tall-type iron buoys and 1 bell buoy were established. Thirteen additional acetylene gas buoys have been ordered for use in this channel and 4 spare buoys. It is expected the additional buoys will be placed before January 1, 1916. Amount expended to June 30, 1915, \$123,025.82.

Chesapeake Bay Entrance, Va.—The act of May 27, 1908, appropriated \$27,000 for one buoy to be placed off Cape Henry, one buoy to be placed to the northward of the Middle Ground near the entrance to Chesapeake Bay, and one relief buoy. During the year a submarine bell, operated by the action of the sea, has been installed on the buoy placed off Cape Henry, Va., and the relief buoy similarly equipped. Amount expended to June 30, 1915, \$26,836.27.

SIXTH DISTRICT.

Depot for the sixth lighthouse district.—The act of October 23, 1914, appropriated \$125,000 for the purchase of a site and the construction of a wharf and buildings for a depot, sixth lighthouse district. The site has been selected, surveyed, and transfer of deed completed, and the site purchased. Specifications for a creosoted timber wharf have been completed and proposals for construction invited. Plans and specifications for a timber bulkhead have been approved and those for arrangement of storehouse are under way. Amount expended to June 30, 1915, \$60,774.48.

EIGHTH DISTRICT.

Atchafalaya Entrance Channel, La.—The act of October 22, 1913, appropriated \$50,000 for erecting aids to navigation on the Atchafalaya Entrance Channel, La. By letter of November 30, 1914, the War Department advised the Department of Commerce that a portion of the land along the Point Au Fer Reef had been transferred for lighthouse purposes (for the site of the Point Au Fer Reef Lighthouse). Plans and specifications were prepared for the construction of a lighthouse, with fourth-order light and bell fog signal, on 25 iron-cased piles; a carbide house, boathouse, boatways, wharf and walks on Point Au Fer Reef, two lighted beacons each on nine iron-cased piles along the channel in the Gulf outside of the reef, and three lighted beacons each on four iron-cased piles along the channel in Atchafalaya Bay. Amount expended to June 30, 1915, \$2,685.

Galveston Jetty Light Station, Tex.—The act of June 11, 1896, appropriated \$35,000, and the act of May 27, 1908, \$10,000 for establishing a light and fog signal at or near the outer end of one of the jetties at Galveston Harbor, Tex. During the fiscal year the structural steel for the superstructure was purchased and delivered at Galveston; a construction wharf was erected at the site; the structural steel substructure and superstructure were erected; and the ribbed expanded metal reinforcement and cement for the walls and other materials were purchased and construction commenced. It is expected to complete the structure by December, 1915. Amount expended to June 30, 1915, \$36,203.39.

Sabine Pass Jetty, Tex.—The act of May 27, 1908, appropriated \$40,000 for a light and fog signal at or near the end of Sabine Pass Jetty. Nothing has been done on the work, in view of the proposed project of the War Department to extend the jetties to the 25-foot contour, a distance of possibly 2 miles. At the close of the fiscal year 1915 no money had been expended or obligated.

NINTH DISTRICT.

Navassa Island Light Station, West Indies.—The act of October 22, 1913, appropriated \$125,000 for the erection of a light station on this island. Surveys were made in preceding fiscal year, and plans, specifications, contract forms, etc., were prepared and the work advertised. Bids will be opened in September, 1915, and it is expected that about two years will be required for completion. No expenditures to June 30, 1915.

TENTH DISTRICT.

Ashtabula Harbor, Ohio.—The act of October 22, 1913, appropriated \$45,000 for rearranging, rebuilding, and improvement of aids to navigation at Ashtabula Harbor, Ohio. Detailed plans were completed. Acetylene flashing lights were established on east and west pierheads July 17, 1914. On June 30, 1915, the forms for building up

the concrete base had been completed and deposition of concrete begun. Metal work for addition to fog-signal house is being constructed under contract. Diaphone fog-signal apparatus has been ordered. It is expected to complete the project during the present season. Amount expended to June 30, 1915, \$8,987.29.

Cleveland Harbor, Ohio.—The act of October 22, 1913, appropriated \$17,600 for the removal, reconstruction, and improvement of the fog-signal station at Cleveland, Ohio. Metal work for the building is being constructed under formal contract and was practically completed at the shops on June 30, 1915. The work at the site will be commenced in the near future. It is planned to complete the structure during the present season. Diaphone fog-signal apparatus has been ordered. Amount expended to June 30, 1915, \$221.42.

Lorain Harbor, Ohio.—The act of October 22, 1913, appropriated \$35,000 for a light and fog signal station and improvement of aids to navigation at Lorain Harbor, Ohio. A fourth-order lens and diaphone fog-signal apparatus have been ordered. Preparation of detailed plans are well advanced. It is expected to begin operations at the site early in the spring of 1916. Amount expended to June 30, 1915, \$3,473.97.

ELEVENTH DISTRICT.

Detroit River, Michigan.—The act of March 4, 1911, appropriated \$210,000 for establishing aids to navigation along the Livingstone Channel, Detroit River, Mich., including authority to locate and construct lights and to place buoys necessary to properly mark this channel. On June 30, 1915, 12 concrete piers had been completed, and 8 placed in commission. The other 4 await the completion of contemplated changes in the channel before they can be utilized. Fourteen gas buoys and 20 spar buoys are now used to mark the channel in addition to the lights on piers. Two of the above piers were constructed and the lights placed in operation within the year. Plans have been prepared for the construction of a light and fog signal at the south end of the channel. Two additional pier lights will be established, taking the place of two gas buoys now maintained, so soon as the proposed widening of the channel shall have been completed. Total expenditure to June 30, 1915, \$143,127.38.

Ashland, Wis.—The act of October 22, 1913, appropriated \$25,000 for the construction of aids to navigation at Ashland, Wis. The project as approved, and now being carried out, consists in an electrically operated light and fog signal on the outer end of the breakwater, supplied with power through a submarine cable to shore connected with the city power lines. The construction of a reinforced concrete tower on the breakwater, for housing the light and signal, is now nearing completion and the submarine cable has been laid. A dwelling and boathouse for one keeper will be constructed on shore sites purchased for the purpose. The operation of both signal and light will be controlled from a shore control station near the dwelling. It is expected that the work will be completed about October 15, 1915, and the station then placed into operation. Amount expended to June 30, 1915, \$19,093.32.

Superior Entry, Wis.—The act of June 30, 1906, appropriated \$20,000 for range lights at Superior Pierhead, Lake Superior, Wis. The act of March 4, 1911, appropriated \$25,000 additional for the completion of lighting of breakwaters and piers at Superior Entry, Wis. Lights on the outer north breakwater and inner north pierhead were completed and established on October 10, 1912. The main light and fog signal station was completed and placed into commission on June 30, 1913. The inner south pierhead light was completed on October 10, 1912, and went into commission on June 12, 1914, when the remains of the old breakwater outside it had been dredged away. An additional light at the inner end of the south canal pier and known as Superior Harbor Basin Light No. 1 was established on June 30. An additional dwelling for this station, made necessary by the additional assistant authorized, is now under construction and will soon be completed. Total cost of work to date, \$37,816.14.

TWELFTH DISTRICT.

Manistique, Mich.—The act of October 22, 1913, appropriated \$20,000 for aids to navigation, Manistique, Mich. The lot for keepers dwelling has been surveyed, purchased, and title vested in the United States. Materials have all been purchased for the keepers dwelling and construction is in progress. The concrete foundation for Manistique Light Station has been completed and bids have been accepted for construction of a steel tower, in which an electric light will be exhibited in a fourth-order lantern. The installation of a fixed white post lantern on Manistique West Pierhead was completed October 30, 1914. The installation of a 25-foot steel tower and flashing acetylene equipment on Manistique West Breakwater was completed October 30, 1914. Amount expended under this appropriation to June 30, 1915, \$12,261.58.

Oconto, Wis.—The act of October 22, 1913, appropriated \$5,000 for pierhead lights, etc., Oconto Harbor, Wis. The installation of a 25-foot steel tower and flashing acetylene equipment for Oconto Harbor South Pierhead Light was completed April 12, 1915. A gas and bell buoy for Oconto Harbor Channel has been ordered and early delivery is expected. Amount expended under this appropriation to June 30, 1915, \$2,105.

White Shoal, Mich.—The act of March 4, 1907, appropriated \$250,000 for a light and fog signal station at White Shoal, north end of Lake Michigan, to replace the White Shoal Light Vessel, which was then located over these dangerous shoals. The light was placed in commission on September 1, 1910, and the fog signal on September 15, 1910. A submarine bell was established September 20, 1911. A water-supply system was installed in October, 1911. An oil-storage system was installed during June, 1913. An auxiliary flashing acetylene winter light was installed during December, 1914, to serve as an aid to mariners between time station is closed and actual close of navigation. The equipment of the three boat cranes with air drive is still under consideration and will be purchased during present season. Amount expended under this appropriation to June 30, 1915, \$225,035.07.

SIXTEENTH DISTRICT.

Cape St. Elias Light and Fog-Signal Station.—The act of October 22, 1913, appropriated \$115,000 for a light and fog signal to be established at or near Cape St. Elias, Alaska. The lens, pedestal, and clock for this light have been ordered. The metal superstructure of the tower, including the watch room and gallery, and the helical bar second-order lantern has been completed and shipped to San Francisco for exposition purposes as have the two air compressors for the fog signal together with air sirens, trumpets, air tanks, and piping for the same. Fuel-oil storage tanks have been completed and delivered. The site has been selected on Cape St. Elias and up to June 30, 1915, the following work had been accomplished at the site: Plan for tower and fog signal prepared and approved, surveys completed and plotted, construction camp established and the camp and storage buildings, shops, etc., completed, temporary and permanent tramways completed, concrete plant, bins, etc., completed ready for actual construction, excavation 50 per cent complete, screening and delivery of sand and gravel 50 per cent complete, delivery of materials to the site 30 per cent complete. It is expected that the light will be in operation about the beginning of the next fiscal year and the fog signal in the fall of 1916. The amount expended to June 30, 1915, is \$22,142.48.

Aids to navigation, Alaska.—The acts of March 4, 1911, and August 1, 1914, each appropriated \$60,000 for establishing aids to navigation in Alaskan waters. During the year 1 acetylene light was established, 1 oil light changed to acetylene, structures for 11 lights were erected ready for illuminating apparatus, and material is on hand or in transit for 19 others, nearly all of which it is expected will be in commission by the fall of 1915. The appropriation of 1911 has been expended and to June 30, 1915, the total expenditure from the appropriation of August 1, 1914 was \$43,073.98.

SEVENTEENTH DISTRICT.

Aids to navigation, Puget Sound, Wash.—The act of October 22, 1913, appropriated \$30,000 for aids to navigation and improvements of existing aids in Puget Sound and adjacent waters, Washington. Under this appropriation the following work was performed:

Slip Point Light Station, Wash.: Change of type and characteristic; remodeling of light and fog signal building; and change of fog signal, to cost approximately \$12,000. Expended on this project to June 30, 1915, \$3,494.00. Probable date of completion November 30, 1915.

Hein Bank Gas and Bell Buoy, Juan de Fuca Strait, Wash., established at a cost of \$2,449.

Post Point Gas and Bell Buoy, Bellingham Bay, Washington Sound, Wash., establishing. Expended on this project to June 30, 1915, \$2,469. Probable date of completion, August 1, 1915.

Waterman Point Light, Port Orchard, Puget Sound, Wash., establishing a flashing acetylene light. Expended on this project to June 30, 1915, \$840. Probable date of completion, October 1, 1915.

Additional aids will be established under this appropriation as rapidly as possible.

**UNEXPENDED BALANCES ON JUNE 30, 1915, FROM APPROPRIATIONS
FOR SPECIAL WORKS.**

District.	Title of appropriation.	Acts.	Balance.
General..	Tender for first lighthouse district.....	May 27, 1908; Mar. 4, 1909....	\$155,295.33
	Tender for fifteenth lighthouse district.....	Mar. 4, 1907.....	10,851.69
	Light vessels for general service.....	Aug. 24, 1912.....	130,000.00
	Lighthouse tender, general service.....	Aug. 26, 1912.....	162,452.54
	Oil houses for light stations.....	Jan. 25, 1915.....	249,347.20
	Lightkeepers' dwellings.....	June 25, 1910.....	2,774.71
2d.....	Cape Cod Canal Lights, Mass.....	May 27, 1908.....	963.59
3d.....	Staten Island and West Bank Light Station, N. Y.....	Aug. 1, 1914.....	26,215.55
	Newark Bay Beacon Lights, N. J.....	June 30, 1906; Mar. 4, 1909.....	26,073.97
	Point Judith Breakwater Lights, R. I.....	Mar. 4, 1907; Oct. 22, 1913.....	5,933.52
	Repairs to lighthouse tender Pansy.....	Mar. 4, 1909.....	612.64
	Staten Island lighthouse depot, N. Y.....	do.....	1,131.38
	Stonington Light Station, Conn.....	Mar. 4, 1911; Aug. 1, 1914.....	23,544.71
	Rondout Creek Light Station, N. Y.....	do.....	492.27
	Hunts Point Light Station, N. Y.....	do.....	18,400.25
4th.....	Joe Flogger Shoal Light Station, Delaware River.....	do.....	5,000.00
	Miah Maull Shoal Light Station, Delaware River.....	June 30, 1906.....	39,396.79
		June 30, 1906; Mar. 4, 1907; Mar. 4, 1911.....	897.52
5th.....	Chesapeake Bay, lighted buoys.....	May 27, 1908.....	163.73
	Thimble Shoal Light Station, Va.....	June 25, 1910; Aug. 26, 1912.....	7,047.24
	Fort McHenry Channel Range Lights, Md.....	Mar. 4, 1911.....	55,717.58
	Lighting Norfolk Harbor, Va.....	do.....	17,881.84
6th.....	Tender for engineer, sixth lighthouse district.....	May 27, 1908.....	27,078.60
	Depot for sixth lighthouse district.....	Oct. 22, 1913.....	64,225.52
8th.....	Galveston Jetty Light Station, Tex.....	June 11, 1896; May 27, 1908.....	9,182.14
	Tender for inspector eighth lighthouse district.....	Mar. 4, 1907.....	6,084.36
	Sabine Pass Jetty Light Station, Tex.....	May 27, 1908.....	40,000.00
	Southwest Pass Light Vessel, Mississippi River.....	Oct. 22, 1913.....	123,364.41
	Aids to navigation, Atchafalaya Entrance Channel, La.....	do.....	47,317.53
9th.....	San Juan lighthouse depot, P. R.....	May 27, 1908.....	60
	Navassa Island Light Station, W. I.....	Oct. 22, 1913.....	125,000.00
10th.....	Buffalo Breakwater North End Light Station, N. Y.....	Mar. 4, 1911.....	26.04
	Point Abino Light Vessel, Lake Erie.....	do.....	10,125.77
	Cleveland Fog-signal Station, Ohio.....	Oct. 22, 1913.....	17,378.58
	Aids to navigation, Ashtabula Harbor, Ohio.....	do.....	36,012.71
	Aids to navigation, Lorain Harbor, Ohio.....	do.....	32,673.62
11th.....	Superior Pierhead Range Lights, Wis.....	June 30, 1906.....	7,224.98
	Detroit River Lights, Mich.....	Mar. 4, 1911.....	66,872.62
	Aids to navigation, St. Marys River, Mich.....	Aug. 26, 1912.....	189.91
	Aids to navigation, Ashland, Wis.....	Oct. 22, 1913.....	5,906.68
12th.....	Milwaukee Light Vessel, Wis.....	May 27, 1908.....	1,552.60
	White Shoal Light Station, Lake Michigan.....	Mar. 4, 1907.....	24,820.93
	Oconto Harbor Lights, Wis.....	Oct. 22, 1913.....	2,773.53
	Aids to navigation, Manistique, Mich.....	do.....	12,579.03
16th.....	Aids to navigation, Alaska.....	Mar. 4, 1909; Aug. 1, 1914.....	38,706.12
	Cape St. Elias Light Station, Alaska.....	Oct. 22, 1913.....	192,976.01
17th.....	Aids to navigation, Puget Sound, Wash.....	do.....	17,679.92
19th.....	Kauai Island Light Station, Hawaii.....	May 27, 1908; Aug. 1, 1914.....	31.18

**BALANCES OF SPECIAL APPROPRIATIONS CARRIED TO THE SURPLUS
FUND ON JUNE 30, 1915.**

The following named balances of special appropriations under the Lighthouse Service remaining on the books of the Treasury Department, and relating to works which had been completed and against which no obligations were known to exist were carried to the surplus fund on June 30, 1915.

Storehouses for oil.....	\$10.98
Monhegan Island Light Station, Me.....	1,822.43
Negro Point Light Station, N. Y.....	2,649.08
Point Judith Lighted Buoy, R. I.....	534.31
Tender for Engineer, Third Lighthouse District.....	272.15
Staten Island Lighthouse Depot, N. Y., (repairs to wharves).....	23.26
Brandywine Shoal Light Station, Del.....	39.66
Cape Fear River Lights, N. C.....	126.73
Lincoln Rock Light Station, Alaska.....	225.51

Total carried to surplus fund..... 5,704.11

**SAVING OF LIFE AND PROPERTY BY VESSELS OR EMPLOYEES OF THE
LIGHTHOUSE SERVICE DURING THE FISCAL YEAR 1915.**

District.	Vessel or employee rendering service.	Vessel, etc., aided.	Nature of assistance.
1st.....	Tender Hibiscus..... J. Burke, keeper, Cape Neddick Light Station, Me. E. Reed, keeper, Whitehead Light Station, Me. J. W. Jellison, keeper, Tenant Harbor Light Station, Me. Tender Hibiscus..... Tender Zizania..... Tender Hibiscus.....	Schooner Harriet C. Whitehead. Unknown man..... Motor boat..... Motor boats..... Motor boat..... Launch..... Schooner C. W. Dexter	Pulled vessel off Ram Island Ledge, Me. Saved man from probable drowning; furnished him with clothing and shelter. Recovered boat adrift near station. Towed 2 disabled boats to their moorings. Towed to port disabled boat with 2 men on board. Rescued launch, with 2 men aboard, caught in ice. Towed into harbor schooner found in dangerous position with rudder and 1 anchor and chain gone.
2d.....	H. C. Towle, keeper, The Graves Light Station, Mass. E. C. Mott, assistant keeper, Deer Island Light Station, Mass. J. E. Barrus, keeper, and E. H. Hopkins, assistant keeper, Cape Poge Light Station, Mass. Tender Anemone..... Light Vessel No. 73, Mass.... Tender Anemone..... G. I. Cameron, first assistant keeper, and E. Mueller, second assistant keeper, The Graves Light Station, Mass. A. A. Howard, keeper, Stage Harbor Light Station, Mass. E. C. Hadley, keeper, Bakers Island Light Station, Mass. Tender Anemone..... H. C. Towle, keeper, The Graves Light Station, Mass. J. B. McCabe, keeper, and E. C. Mott, assistant keeper, Deer Island Light Station, Mass. J. E. Barrus, keeper, and E. H. Hopkins, assistant keeper, Cape Poge Light Station, Mass. Light Vessel No. 47, Mass.... Light Vessel No. 73, Mass....	Motor dory and motor boat. The Morning Star; F. McAlpine, owner. Power yacht Lanagante. Four-masted schooner Geo. F. Scannell, of New York. Power boat; Frederic Nickerson, owner. Tug Henry Maurer, with tow. Motor boat..... U. S. S. Celtic..... Motor dory..... .....do..... Three-masted schooner Roger Drury. Dories from schooner Washakie. Dory from schooner Washakie. Power boat; D. Charter, owner. Barney Marsden..... ..... .....do..... Schooner Nettleton; Capt. Lamborn, owner. Boat from U. S. training station.	Picked up disabled dory with motor boat in tow at East Point, Nahant, and towed to Bass Point; heavy sea. Rescued 2 men from burning motor boat; furnished food, dry clothing, and lodging for the night. Assisted in working yacht off bar. Towed to channel schooner anchored in dangerous position, with distress signals up. Rescued disabled boat and owner. Towed to Hyannis wharf disabled tug anchored with mud scow off Point Gammon. Furnished food and shelter for night to 2 officers and 6 sailors from ship who were unable to return on account of heavy wind. Saved horse from sinking in quicksand and water. Furnished food to 2 Italian fishermen; also put engine in working condition. Attempted to pull stranded steamer from shoals; unsuccessful. Towed to Lynn a disabled boat drifting to sea with fisherman aboard. Rescued fisherman in disabled boat. Assisted schooner, which had struck 2½ miles south of station. Assisted and supplied food to 6 men adrift in dories from schooner. Assisted and supplied food to 2 men adrift in dory from schooner. Went to assistance and towed disabled boat to safety. Rescued helpless man who had fallen off dock. Towed ashore disabled boat, containing 3 persons. Rescued disabled boat; brought 3 men and 2 women to station; took care of occupants overnight. Assisted in floating vessel ashore on Duck Island and taking boat to Saybrook. Took to place of safety, after 2 hours' work, boat drifting to sea loaded with sand and containing an exhausted man.
3d.....	Ram Island Reef Light Vessel No. 23, Conn. A. Daunt, master, Bartlett Reef Light Vessel No. 13, Conn., and C. J. Murray, boatbuilder, general depot. W. F. Hill, keeper, Isle La Motte Light Station, Vt. E. M. Usinger, keeper, Stratford Shoal Light Station, N. Y. J. Smith, keeper, Duck Island Light, Conn. J. C. Bouley, keeper, Gull Rocks Light Station, R. I.	..... ..... Motor boat..... .....do..... Schooner Nettleton; Capt. Lamborn, owner. Boat from U. S. training station.	..... ..... Towed ashore disabled boat, containing 3 persons. Rescued disabled boat; brought 3 men and 2 women to station; took care of occupants overnight. Assisted in floating vessel ashore on Duck Island and taking boat to Saybrook. Took to place of safety, after 2 hours' work, boat drifting to sea loaded with sand and containing an exhausted man.

SAVING OF LIFE AND PROPERTY BY VESSELS OR EMPLOYEES OF THE LIGHTHOUSE SERVICE DURING THE FISCAL YEAR 1915—Continued.

District.	Vessel or employee rendering service.	Vessel, etc., aided.	Nature of assistance.
3d (con.).	A. G. Baldwin, keeper, Bridgeport Harbor Light Station, Conn.	C. A. Strat.....	Rescued from drowning in Long Island Sound.
	J. Petterson, keeper, Southwest Ledge Light Station, Conn., and G. Lepol, laborer, general depot.	Power boat.....	Towed disabled boat and 3 men to safety; rough sea and strong wind.
	W. J. Murray, keeper, Little Gull Island Light Station, N. Y.	Schooner Andrew Nebinger.	Assisted schooner stranded on reel; helped to place anchors.
	W. F. Petzolt, assistant keeper, Stratford Point Light Station, Conn.	Motor boat Hale.....	Took to safety disabled boat containing 2 boys.
	G. Ehrhardt, keeper, and J. Hamilton, assistant keeper, Long Beach Bar Light Station, N. Y.	Motor boat Kitty.....	Picked up abandoned boat; turned it over to civil authorities.
	J. B. Murdock, keeper, Rondout Light Station, N. Y.	Exhausted swimmer..	Assisted exhausted swimmer carried out of his course.
	L. P. Brown, keeper, Cold Spring Harbor Light Station, N. Y.	Open launch.....	Rescued and took ashore disabled launch and 4 occupants.
	Do.....	Canoe.....	Rescued 2 young men from filled canoe during heavy storm, and gave them supper, bed, and breakfast.
	W. L. Tutty, keeper, and A. Herne, assistant keeper, New Haven Light Station, Conn.	Motor boat; A. P. Ives and J. H. Burton, owners.	Rescued disabled motor boat and took care of occupants overnight.
	Tender Tulip.....	Tug Thomas O'Brien.	Assisted and towed disabled tug to Gravesend Bay.
	E. E. Gildersleeve, keeper, Saybrook (Lynde Point) Light Station, Conn.	Power boat.....	Assisted ashore 2 occupants of boats caught in ice; cared for them over night and assisted in repairing boat.
	T. J. Murray, keeper, Esopus Meadows Light Station, N. Y.	Ice boat.....	Assisted ashore 2 men and 1 woman whose boat had broken through ice; supplied their needs at station.
	E. E. Gildersleeve, keeper, Saybrook (Lynde Point) Light Station, Conn.	Disabled boat, Capt. J. Mulhaley.	Saved and brought ashore boat, with broken rudder, caught in ice; took care of occupants.
	Cornfield Point Light Vessel No. 48, Conn.	Power boat.....	Towed disabled boat, with 2 occupants, to light vessel; repaired engine.
	W. F. Rhodes, keeper, and V. H. Stanton, assistant keeper, Romer Shoal Light Station, N. Y.	Canoe.....	Rescued 2 men and canoe caught in storm off Romer Shoal and capsized.
	W. H. H. Lake, jr., keeper, Shinnecock Bay Light Station, N. Y.	Boat.....	Assisted boat, with woman occupant, off of shoal.
	L. P. Brown, keeper, Cold Spring Harbor Light Station, N. Y.	Open dory with sail; W. Hill, owner.	Went to assistance of 5 men in disabled boat, supplied oars and towed boat to Oyster Bay.
	J. J. Barnes, keeper, North Dumpling Light Station, N. Y.	Power boat.....	Pulled ashore boat and 2 occupants stranded ashore in strong wind before much damage done.
	J. A. Murdock, keeper, Rondout Light Station, N. Y.	Motor boat Natalie, J. H. Flannery, N. Y.	Assisted in raising sunken boat.
4th.....	W. Spear, keeper, Deep Water Point Range Front Light Station, N. J.	Drowned boy.....	Recovered body of boy drowned near station.
	H. C. Wingate, keeper, Delaware Breakwater Range Front Light Station, Del.	Drowning man.....	Rescued from probable drowning man fallen overboard from passing steamer.
	C. J. Murphy, engineer of Tender Iris.	.....do.....	Saved man from drowning.
	H. C. Wingate, keeper, and H. P. Marshall, first assistant keeper, Delaware Breakwater Range Front Light Station, Del.	Motor boat.....	Rescued 4 men drifting out to sea in disabled boat.
5th.....	G. A. Holston, laborer in charge, Lewes Lighthouse Depot, Del.	.....	Made 28-mile trip to sea to bring ashore fireman of Fenwick Island Shoal Light Vessel.
	C. E. Respass, keeper, E. Davis, assistant keeper, Windmill Point Light Station, Va.	Gasoline launch.....	Assisted occupants of disabled launch.

SAVING OF LIFE AND PROPERTY BY VESSELS OR EMPLOYEES OF THE LIGHTHOUSE SERVICE DURING THE FISCAL YEAR 1915—Continued.

District.	Vessel or employee rendering service.	Vessel, etc., aided.	Nature of assistance.
5th (con.)	W. L. Rebbel, clerk, office of lighthouse inspector, fifth district.	J. W. Walsh, clerk, fifth inspector's office.	Attempted rescue of Clerk Walsh from drowning.
	M. Hudgins, keeper, and J. M. Ellis, first assistant keeper, Smith Point Light Station, Va.	Motor boat.....	Assisted 2 men when motor had become disabled.
	R. H. Bertram, master, Relief Light Vessel No. 2.	Power yacht Phalarope.	Assisted leaking yacht.
	J. T. Twiford, assistant keeper, Long Shoal Light Station, N. C.	Power boat Robena, Capt. S. Spencer.	Assisted disabled boat.
	T. H. Baum, keeper, Long Shoal Light Station, N. C.	Small sloop.....	Assisted occupants when sloop went aground.
	A. J. English, keeper, Harbor Island Bar Light Station, N. C.	Power boat Viola.....	Assisted disabled United States mail boat.
	L. H. Staubly, keeper, Blakistone Island Light Station, Md.	Sloop Volunteer.....	Assisted sloop in leaking and sinking condition.
	G. M. Willis, sr., keeper, Point No Point Light Station, Md.	W. Yeatman and child	Rescued assistant keeper and child from drowning.
	U. B. Jennett, second officer, tender Jessamine.	Gasoline freighter Margaret Atkinson of Baltimore, Md.	Towed loaded, disabled freighter into Annapolis.
	C. B. Gray, keeper, Greenbury, Point Shoal Light Station, Md.	Canoe.....	Assisted 2 oystermen in capsized canoe.
	W. F. Outten, first officer, tender Woodbine.	.....do.....	Rescued 2 men from drifting canoe.
	J. Hanson, master, Relief Light Vessel No. 72.	S. S. Washingtonian..	Rescued 39 men from steamship rammed off Fenwick Island, Del.
	T. H. Baum, keeper, and J. T. Twiford, assistant keeper, Long Shoal Light Station, N. C.	Schooner Hamlet of Hatteras, N. C.	Assisted schooner run aground on Long Shoal, N. C.
	B. Wroldsen, quartermaster, tender Jessamine.	C. Gregory and C. Sawyer.	Rescued men from drowning after boat capsized in heavy squall.
	A. J. Davidson, first officer, and J. Whitehurst, second assistant engineer, Woodbine.	Tender Woodbine.....	Rendered prompt assistance in saving tender from fire.
	J. R. Montelro, master, tender Ivy.	Schooners Mary S. Ewing, and Julia and Anne.	Attempted to rescue schooner Mary S. Ewing in a gale; assisted schooner Julia and Anne.
	A. M. Thistel, master, Cape Charles Light Vessel No. 49.	Light Vessel No. 49....	Kept vessel on station, submarine signal and whistle in operation during heavy storm of Apr. 3, 1915.
	F. J. Pusey, mate, in charge of Light Vessel No. 97.	Motor boat.....	Assisted 4 occupants of disabled motor boat.
	E. Meekins, jr., keeper, and W. H. Etheridge, second assistant keeper, Bodie Island Light Station, N. C.	Mail launch Swastika.	Assisted disabled launch with 7 passengers aboard.
	E. L. Thomas, keeper, Tangier Sound Light Station, Va.	Motor boat Bernice L.	Rescued 3 men from boat sunk off station.
	W. R. Schoenfelder, keeper, Fishing Battery Light Station, Md.	Man overboard.....	Assisted man who fell overboard from dredge near station.
	A. J. English, keeper, and C. R. Austin, assistant keeper, Harbor Island Bar Light Station, N. C.	Schooner Davis, Davis, N. C.	Assisted schooner grounded on Harbor Island Bar, N. C.
	W. F. Outten, master, tender Laurel.	Schooner Alert, Seaford, Del., Capt. Winfield Scott.	Assisted schooner flying distress signals; towed her into Annapolis.
6th.....	Tender Mangrove, Master E. C. Tull commanding.	Schooner Wm. H. Yerkes; Dunn Elliot Co., owners.	Brought ashore master and 10 of crew of wrecked schooner.
	Do.....	U. S. Engineers dredge Savannah.	Pulled dredge off shoals, St. Simon Sound, Ga.
	J. Robertson, keeper, and M. B. Wilder, assistant keeper, Little Cumberland Island Light Station, Ga.	Parties searching bodies of crew of Rambler, wrecked near station.	Gave shelter and otherwise assisted searching parties.
	J. Lindquist, keeper, and W. Lindquist, assistant keeper, Mosquito Inlet Light Station, Fla.	Yacht Niagara of New York; J. S. Simmons, owner.	Took owner and family off yacht ashore in breakers; worked off yacht and took it to station.

SAVING OF LIFE AND PROPERTY BY VESSELS OR EMPLOYEES OF THE LIGHTHOUSE SERVICE DURING THE FISCAL YEAR 1915—Continued.

District.	Vessel or employee rendering service.	Vessel, etc., aided.	Nature of assistance.
6th (con.)	H. S. Svendsen, keeper, South Channel Range, etc., Light Station, S. C.	Launch; name and owner unknown.	Saved launch ashore on breakwater at Sullivans Island, S. C.
	L. H. Bringlee, keeper, G. N. Jackson, first assistant keeper, and A. E. Burn, second assistant keeper, Charleston Light Station, S. C.	Launch.....	Assisted to station and took care of 4 fishermen; repaired launch.
	Do.....	Various small boats...	Furnished food and clothing to 30 fishermen washed ashore on Morris Island, S. C.
	C. P. Honeywell, keeper, J. B. Butler, first assistant keeper, and O. F. Quartermaster, second assistant keeper, Cape Canaveral Light Station, Fla.	Steamer <i>Loando</i> ; owner unknown.	Assisted ashore officers and crew of wrecked steamer; cared for 3 of crew at station.
7th.....	T. M. Kelly, keeper, J. P. Roberts, jr., first assistant keeper, and T. L. Kelly, second assistant keeper, Rebecca Shoal Light Station, Fla.	Steamers <i>Nordvahlen</i> and <i>Veenbergen</i> .	Assisted steamers ashore near station.
	C. H. Gardner, keeper, Cedar Keys Light Station and Turning Point Light, Fla.	Row boat.....	Rescued from drifting boat man apparently insane.
	H. P. Weatherford, keeper, and R. Palmer, second assistant keeper, Fowey Rocks Light Station.	Yacht <i>May Belle</i>	Rescued 5 passengers from yacht which sank immediately after rescue.
	Tender <i>Arbutus</i>	American steamer <i>Standard</i> .	Helped disabled steamer to raise anchor.
	C. G. Johnson, keeper, and H. A. Pierce, first assistant keeper, Sand Key Light Station, Fla.	Launch.....	Helped off rocks launch with 4 men aboard.
	Tender <i>Camellia</i>	Racing sloop <i>Stranger</i> ; owner unknown.	Righted and towed to port boat capsized during squall.
8th.....	Mrs. M. R. Norvell, keeper, Port Ponchartrain Light Station, La.	Man on steamer <i>Hanover</i> .	Brought to station man taken suddenly ill, and cared for him until death.
	Tender <i>Sunflower</i>	Schooner <i>Maud B. Krumm</i> ; owner unknown.	Furnished provisions.
	G. R. Smith, keeper, and L. R. Smith, assistant keeper, Red Fish Bar Cut Light Station, Tex.	Launch.....	Assisted disabled launch; cared for the 4 occupants overnight.
	W. W. Bayly, keeper, Chandeleur Light Station, La.	Schooner <i>Madeline</i> ; owner unknown.	Furnished shelter to woman and child taken from schooner which had gone ashore.
9th.....	Launch of Tender <i>Myrtle</i>	Ferry launch <i>Dicosha</i> .	Towed to safety wrecked launch with passengers.
	J. M. Agostini, keeper, Catano Range and Anegado Shoal Range Lights.	Launch.....	Assisted disabled launch.
	E. T. O'Melia, former chief clerk.	Canoe.....	Saved man from capsized canoe.
10th.....	J. C. Belden, keeper, Rock Island Light Station, N. Y.	Large power boat.....	Rescued disabled boat with 5 men on board.
	Do.....	Launch <i>Indunno</i> of Gananoque, Ontario.	Repaired disabled launch towed to station.
	Do.....	Launch.....	Assisted stranded launch into deep water; furnished bed and breakfast for 2 occupants.
	B. A. Dissett, first assistant keeper, Toledo Harbor Light Station, Ohio.	.....do.....	Towed ashore launch with 8 men aboard, disabled and in dangerous position.
	C. Duggan, keeper, S. Bass Island Light Station, Ohio.	Steam barge <i>Isabel Boyce</i> .	Assisted in landing and cared for crew of 8 from burning barge.
	R. C. Graves, keeper, Galloo Island Light Station, N. Y.	Small power boat.	Towed launch 4 miles for supply of gasoline.
	F. Ritter, keeper, Sandusky Bay Inner Range Light Station, Ohio.	Two launches.....	Towed to safety disabled launch with 1 occupant, and motor boat with 4 occupants.
	C. H. Tucker, keeper, Oswego Light Station, N. Y.	Rowboat.....	Brought to station 2 women rescued from drowning.
	H. E. Walts, keeper, Sunken Rock Light Station, N. Y.	Skiff.....	Rescued man in skiff from being run down by steamer.

SAVING OF LIFE AND PROPERTY BY VESSELS OR EMPLOYEES OF THE LIGHTHOUSE SERVICE DURING THE FISCAL YEAR 1915—Continued.

District.	Vessel or employee rendering service.	Vessel, etc., aided.	Nature of assistance.
11th.....	R. Carlson, keeper, Whitefish Point Light Station, Mich.	Steamer Ora Endress..	Rescued 11 men from capsized vessel; provided food and clothing at station.
	W. G. Marshall, keeper, and F. McFall, assistant keeper, Windmill Point Light Station, Mich.	Launch....	Pulled launch at sea wall out of reach of heavy sea.
	J. Metivier, keeper, and L. Hudak, third assistant keeper, Spectacle Reef Light Station, Mich.	Motor boat Effie.....	Towed disabled launch to shore.
12th.....	E. C. Johnson, assistant keeper, Calumet Pierhead Light Station, Ill.	Sloop Rascal....	Assisted drifting sloop, with 3 men on board.
	J. M. Robinson, keeper, and H. Osby, first assistant keeper, Calumet Harbor Light Station, Ill.	Motor boat T. Bradwell	Assisted disabled motor boat with 6 men aboard.
	S. M. Danielsen, keeper, Chicago Harbor Light Station, Ill.	Gasoline launch The Bug.	Assisted launch, with 1 man aboard, from drifting out into lake.
	G. Fox, second assistant keeper, Chicago Pierhead Range Light Station, Ill.	Drowning man..	Rescued man who fell from dock near station.
	F. A. Drew, keeper, and G. W. Drew, assistant keeper, Green Island Light Station, Wis.	Gasoline launch Alice W.	Towed disabled launch to safety.
	Do.....	Motor boat.....	Assisted 4 men in leaky boat.
	Do.....	do.....	Brought to safety 2 men and 1 woman in disabled boat.
	F. A. Drew, keeper, Green Island Light Station, Wis.	Gasoline launch, Wesley L.	Assisted grounded launch.
	G. H. Sheridan, keeper, Kalamazoo Light Station, Mich.	Open gasoline launch, Quindess; J. D. Annable, owner.	Rescued 3 women and 4 men; brought launch to safety.
	Do.....	Gasoline launch, Lady Ramer; F. Sholtz, owner.	Assisted launch, with 3 women and 3 men aboard, ashore during gale.
	A. C. Erickson, keeper, Little Traverse Light Station, Mich.	Motor boat.....	Towed to safety disabled launch with 2 men aboard.
	Do.....	Gasoline launch, patrol boat No. 4; State of Michigan, owner.	Towed disabled launch into dock.
	J. Napeizinski, keeper, Manitowoc Breakwater Light Station, Wis.	Dredge and scows; Greiling Bros., owners.	Assisted in floating grounded dredge and scows.
	T. Robinson, keeper, Muskegon Pierhead Range Light Station, Mich.	Motor boat, Bohemian Girl.	Assisted disabled motor boat with 2 boys aboard.
	J. M. Marshall, keeper, and J. H. Sullivan, third assistant keeper, White Shoal Light Station, Mich., and W. Barnum, first assistant keeper, Old Mackinac Point Light Station, Mich.	Launch Ida L.....	Saved launch during gale.
	G. M. S. Hansen, keeper, Sheboygan Pierhead Light Station, Wis.	Rowboat.....	Brought ashore 2 men and capsized boat.
	L. Bourissau, keeper, W. F. Green, first assistant keeper, O. E. Dame, second assistant keeper, and F. L. Moore, third assistant keeper, South Fox Island Light Station, Mich.	Motor boat.....	Brought ashore and repaired disabled sloop; cared for 1 man, 1 woman, 2 children overnight.
	J. Fountain, keeper, and W. Hall, assistant keeper, St. Helena Light Station, Mich.	do.....	Assisted 2 men in leaking boat.
	Do.....	do.....	Towed disabled launch to safe harbor.
	C. H. Hubbard, master, and crew of tender Sumac.	Steamer Joseph C. Butler.	Assisted steamer carried into shoal water.
	H. R. Bevery, keeper, J. Lonne, first assistant keeper, and W. H. Nash, second assistant keeper, Wind Point Light Station, Wis.	Motor boat, Jeanette N.; K. A. Nelson, owner.	Saved launch in rough sea.

SAVING OF LIFE AND PROPERTY BY VESSELS OR EMPLOYEES OF THE LIGHTHOUSE SERVICE DURING THE FISCAL YEAR 1915—Continued.

District.	Vessel or employee rendering service.	Vessel, etc., aided.	Nature of assistance.
12th(con.)	A. Van Velzen, first assistant keeper, Chicago Pierhead Light Station, Ill.	Drowning man.....	Saved from drowning man who fell from pier.
16th.....	E. Pecor, first assistant keeper, and D. O. Kinyon, second assistant keeper, Tree Point Light Station, Alaska.	Launch Cora; C. Nelson, owner.	Furnished oil, gasoline, and provisions to enable boat and occupants to reach Ketchikan.
	N. S. Douglas, keeper, and G. Tibbets, assistant keeper, Lincoln Rock Fog Signal Station, Alaska.	C. Sands, trapper.....	Gave provisions to trapper whose food had become exhausted.
	Do.....	R. S. Mowin, and C. Gorden.	Cared for party, hungry and nearly frozen, who had lost their launch.
	W. J. Pearson, first assistant keeper, W. A. Phillips, second assistant keeper, and W. Rosenberg, substitute keeper, Cape Satch Light Station, Alaska.	Coast Guard Service S. S. Manning and- ing boat.	Cared for late keeper of station during illness; attempted to rescue persons when landing boat capsized.
17th.....	O. H. Wayson, assistant keeper, Smith Island Light Station, Wash.	Motor boat.....	Towed ashore boat with 4 occupants.
	E. A. Brooks, keeper, New Dungeness Light Station, Wash.	Steamer Sioux.....	Assisted steamer and took off passengers.
	Tender Heather, Capt. E. Hammarstrom.	Two fishing boats.....	Convoyed boats to Astoria from Columbia River bar.
	J. M. Coleman, keeper, Tongue Point Lighthouse Depot, Oreg., O. Hoveden, temporary laborer at depot, and G. Pearson, laborer in charge of lights on Columbia River.	Upturned boat.....	Rescued man clinging to upturned boat.
18th.....	Tender Madrono.....	Navy tug Vigilant....	Towed disabled tug off beach at Goat Island.
	Keepers, Pigeon Point Light Station.	Gasoline fishing boat: Union Fish Co., owners.	Hauled boat off rocks and transported it to safety.
	Crew of San Francisco Light Vessel No. 70.	U. S. Navy launch Castro.	Rescued man fallen overboard.

DAMAGE BY COLLISIONS.

The following is a list of the more important collisions affecting the property of the Lighthouse Service which occurred during the fiscal year 1915:

On July 7, 1914, Shovelful Shoal Light Vessel No. 3, Mass., was struck by a barge in tow of the tug *Honeybrook*. Repairs costing \$158 were paid by the owners of the tug.

On August 9, 1914, Pollock Rip Light Vessel No. 47, Mass., was struck by the barge *Henry Failing* in tow of the tug *Concord*, causing damages to the extent of \$785. The owners of the tug *Concord* have agreed to pay for the repairs.

On November 14, 1914, Pollock Rip Relief Light Vessel No. 9, Mass., was struck by a barge in tow of a tug. Cost of repairs \$100. Efforts to ascertain the names of barge and tug have been unavailing.

On December 21, 1914, Seventy Four Bar Buoy, 10, was fouled by the steamer *Sloterdyk*. Estimated damage \$150. As the accident was unavoidable, no action was taken to collect the cost of repairs.

On March 3, 1915, Handkerchief Light Vessel No. 4, Mass., was struck by a barge in tow of the tug *Pejebscot*, and damaged to the extent of \$242, which amount was paid by the owners of the tug.

On April 23, 1915, the tender *Azalea* was struck by a barge in tow of tug *Pejebscot*. The cost of repairs, which amounted to \$108.70, was paid by the owners of the tug.

On January 12, 1915, during a heavy northeast wind, float No. 51 of the New York Dock Co., drifted in the south slip at the general depot dock, Tompkinsville, N. Y., against the bulkhead, breaking two piles and injuring a small building on the bulkhead. Repairs costing \$150 were made by the owners of the float.

On September 23, 1914, the U. S. S. *Drayton* ran into the north side of the north dock at Tompkinsville, N. Y., damaging it to the extent of \$171.50. On October 30, 1914, the U. S. S. *Monaghan* hit the southeast corner of the north dock, damaging it to the extent of \$25. On November 7, 1914, the U. S. S. *Roe* hit the southeast corner of the north dock, damaging it to the extent of \$229. The damages have been repaired by the Government.

On July 24, 1914, the schooner *Charles P. Finney* collided with Manokin River Light, Manokin River, Md. The light structure was rebuilt by the Government at a cost of \$104.22, it being impracticable to fix responsibility for the accident.

On August 3, 1914, the tug *Parole* towing dredge *Nellie* and lighter collided with and destroyed Sewall Point Spit Light, Va. The expense of rebuilding the light structure was borne by the owners of the tug.

On December 15, 1914, the schooner *Lady Grant* collided with Great Island Light, Pamlico Sound, N. C. The light structure was replaced at a cost to the Government of \$236.65, the schooner not being held responsible for the accident.

On March 6, 1915, the schooner *Addie M. Lawrence* collided with Thimble Shoal Light Station, Va. Repairs in the amount of \$600 were made by the owners of the schooner.

On June 2, 1915, barge No. 4 of the New York, Philadelphia & Norfolk Railroad Co., broke away from the tow line of tug *Henrico* of the Southern Transportation Co. and collided with Craney Island Light Station, Va. The cost of repairing the light station in the estimated amount of \$150 will be borne by the Government, neither the barge nor the tug being held responsible for the accident.

On June 22, 1915, the steamer *Ocean View* collided with and destroyed Sewall Point Spit Light, Va. The owners of the steamer have agreed to repair the damage in the approximate amount of \$165.

On March 5, 1915, St. Johns Bluff Light No. 4, St. Johns River, Fla., was run into and damaged. It was found necessary later to rebuild the light at expense to Government, \$121.32. All efforts to ascertain the name of the offending vessel have been unavailing.

On June 5, 1915, the lighthouse tender *Cypress*, lying alongside the customhouse dock, Charleston, S. C., was run into by the U. S. S. *Waban*. Estimated damages \$881. Repairs will be made by the Government.

On January 21, 1915, Apalachicola Range Front Light, Fla., was run into and destroyed by the steamer *City of Eufaula*. Efforts are being made to have the owners of the steamer assume the cost of rebuilding the structure. Estimated cost of rebuilding structure, \$825.

On February 13, 1915, Mobile Ship Channel Light No. 6A, Ala., was collided with by the schooner *C. W. Mills* in tow of the tug *Mary Wittich*. Cost of repairs \$415.90. The matter of payment for repairs is in the hands of the United States attorney.

On March 2, 1915, the S. S. *Italia* collided with the tender *Sunflower* off Galveston Entrance, Tex., damaging the tender to the extent of \$235, which was assumed by the steamship agents.

On May 6, 1915, Pascagoula River Entrance Beacon, 8, Miss., was destroyed by the United States dredge *Pascagoula*, War Department, engineer office, Mobile, Ala. Estimated cost for rebuilding, \$190, which will be borne by the Government.

On November 11, 1914, Horseshoe Reef Gas Buoy, 3, Buffalo Harbor, N. Y., was struck by the steamer *Andrew F. Upson*, broken from its moorings and turned adrift. The bills for repairs, amounting to \$581.01, were paid by the owners of the steamer.

On August 16, 1913, a construction scow belonging to the Lighthouse Service was collided with by the steamer *Joe S. Morrow* at Sault Ste. Marie, Mich., and completely demolished. Efforts were made to recover the value of the scow, approximately \$350, from the owners of the vessel, but were later discontinued owing to the uncertainty of placing responsibility for the accident.^a

On November 27, 1913, the steamer *C. F. Moll* collided with West Neebish Channel Light, No. 23, Mich., damaging the structure. The cost of repairs, amounting to \$2,003.95, was paid by the owners of the steamer.^a

On October 3, 1914, the suction from the steamer *J. Pierpont Morgan*, while bound through the Livingston Channel, Mich., swept the chartered barge *Eleanora* against a timber crib, sinking her with all Government construction material aboard, the latter valued at approximately \$400. Loss was not recovered as the steamer was not held responsible.

On November 19, 1914, the French bark *Pierre Antonine* collided with the structure of the Desdemona Sands Light Station, Oreg. Repairs were made at a cost of \$541. Suit was entered against the owners of the bark and the Government reimbursed.

^a Not included in annual report for 1914.

On July 31, 1914, the steam schooner *James S. Higgins* collided with the Presidio Shoal Gas Buoy, Cal., damaging the lantern to the extent of about \$150. The amount of the cost of repairs will be collected from the owners of the vessel.

In November, 1914, an unknown vessel knocked down and destroyed Redwood Creek Beacon No. 1, Cal. The beacon was replaced by the Government at a cost of \$150.

During April, 1915, the Blind Point Echo Board in the San Joaquin River, Cal., was entirely destroyed, apparently by some unknown vessel. The estimated cost of replacing the echo board is \$700.

The following damage was caused by vessels doing work of the Lighthouse Service during the year:

On August 15, 1914, the tender *Lilac* collided with a lobster car owned by the F. S. Willard Co., Portland, Me., damaging the car to the extent of \$10.

On December 4, 1914, the tender *Tulip*, in order to avoid a collision with a schooner, backed into the dock of the Central Railroad of New Jersey, at Jersey City, N. J., damaging it to the extent of \$289.84. The Lighthouse Service was responsible for these two collisions, and in accordance with section 4 of the act approved June 17, 1910 (36 Stat., 537), appropriations were recommended to Congress in the above amounts, ascertained to be due the claimants, which appropriations were made by the act of March 4, 1915.

PUBLICATIONS OF THE LIGHTHOUSE SERVICE.

[All publications are at present distributed free.]

Publication.	Date of last edition.	Cost of last edition.	Number distributed.
Light Lists:			
Atlantic and Gulf Coasts of United States.....	Jan. 1, 1915	\$4,840	11,536
Pacific Coast of United States, etc.....	.....do.....	1,195	3,011
Great Lakes of United States and Canada.....	Apr. 1, 1915	2,179	4,935
Upper Mississippi River and Tributaries.....	July 15, 1914	872	1,266
Ohio River and Tributaries.....	Sept. 15, 1914	382	1,294
Lower Mississippi River and Tributaries.....	Oct. 20, 1914	162	630
Buoy Lists:			
First district.....	Jan. 1, 1914	1,157	366
Second district.....	.....do.....	949	493
Third district.....	May 1, 1915	1,443	1,877
Fourth district.....	June 1, 1915	307	5,111
Fifth district.....	May 15, 1915	1,315	6,052
Sixth district.....	Jan. 1, 1914	954	480
Seventh district.....	.....do.....	536	410
Eighth district.....	Aug. 15, 1914	509	3,229
Ninth district.....	Dec. 15, 1913	162	88
Tenth district.....	Apr. 1, 1915	271	2,029
Eleventh district.....	.....do.....	580	1,503
Twelfth district.....	.....do.....	379	1,590
Sixteenth district.....	June 1, 1915	253	551
Seventeenth district.....	Jan. 1, 1914	649	250
Eighteenth district.....	.....do.....	399	79
Nineteenth district.....	June 30, 1913	179	90
Miscellaneous publications:			
Weekly Notice to Mariners.....	1915	5,395	195,275
Annual Report, Lighthouse Board.....	1907	2,369	1
Do.....	1908	1,818	1
Do.....	1909	1,897	2
Do.....	1910	361	3
Annual Report, Commissioner of Lighthouses:			
Part I.....	1911	468	4
Part II.....	1911	680	.....
Part I.....	1912	572	7
Part II.....	1912	322	.....
Part I.....	1913	659	.....
Part II.....	1913	228	.....
Part I.....	1914	639	1,350
Part II.....	1914	281	.....
Regulations for the United States Lighthouse Service.....	1914	787	32
Instructions to light keepers.....	1911	49	10
Instructions to officers of vessels.....	1911	32	.....
Medical handbook.....	1912	440	53
Lighthouse Service bulletins.....	1915	204	16,325
Regulations for lighting bridges.....	1914	149	1,091
Regulations for uniforms.....	1912	70	113
Civil-service regulations.....	1913	73	12
Instructions for cost keeping.....	1914	120	132

**COST OF PRINTING FOR THE LIGHTHOUSE SERVICE DURING THE
FISCAL YEAR 1915.**

Light lists.....	\$11, 116
Buoy lists.....	4, 327
Notices to mariners.....	5, 395
Annual Report, Part I.....	639
Annual Report, Part II.....	281
Specifications and other publications.....	2, 517
Forms, reports, record books, etc.....	5, 952
Total.....	30, 227

**MONEY RECEIVED BY THE LIGHTHOUSE SERVICE AND TURNED INTO
THE TREASURY, FISCAL YEAR 1915.**

District.	From sales of vessels.	From sales of other property.	From damages to aids to navigation and other property.	From leases and rentals.
2d.....		\$108. 26	\$90. 20	\$87. 00
3d.....		8, 380. 43	99. 86	106. 00
4th.....		168. 40		5. 00
5th.....		1, 357. 07		
6th.....		1, 834. 24	3. 85	16. 00
7th.....			21. 67	
8th.....		6. 80		11. 00
9th.....		9. 95		
10th.....		422. 22	101. 08	723. 00
11th.....	\$313. 27	1, 343. 51	20. 00	1, 037. 05
12th.....		29. 25		1. 00
16th.....		79. 05		
17th.....	99. 04	399. 25		214. 72
18th.....				1, 876. 61
19th.....		140. 25		
Bureau.....			199. 91	

Total receipts, \$19,304.94.

**APPROPRIATIONS FOR THE BUREAU OF LIGHTHOUSES AND THE LIGHT-
HOUSE SERVICE, SIXTY-THIRD CONGRESS, THIRD SESSION, 1914-15.**

Title.	Act.	Amount.
Maintenance:		
Salaries, Bureau of Lighthouses, 1916.....	Legislative, Mar. 4, 1915.....	\$54, 030
General expenses, Lighthouse Service, 1916.....	Sundry civil, Mar. 3, 1915.....	2, 775, 000
Salaries of keepers of lighthouses, 1916.....	do.....	940, 000
Salaries, lighthouse vessels, 1916.....	do.....	1, 010, 000
Salaries, Lighthouse Service, 1916.....	do.....	375, 000
Total for maintenance.....		5, 164, 030
Special works: Lighthouse tender, general service...	Urgent deficiency, Jan. 25, 1915.....	250, 000
Grand total.....		5, 414, 030

EXPENDITURES DURING THE FISCAL YEAR 1915 FROM APPROPRIATIONS
FOR THE LIGHTHOUSE SERVICE.

[Obligations incurred are not included.]

MAINTENANCE APPROPRIATIONS.

Salaries:

Bureau of Lighthouses, 1914.....	\$2,770.48
Bureau of Lighthouses, 1915.....	60,428.79
Expenses of buoyage: Certified claims.....	509.93
Supplies of lighthouses: Certified claims.....	3.07
Lighting of rivers: Certified claims.....	12.50
Salaries of keepers of lighthouses:	
1914.....	27,237.23
1915.....	884,917.32
Certified claims.....	31.11
Expenses of light vessels: Certified claims.....	195.52
Maintenance of lighthouse tenders: Certified claims.....	774.49
Salaries, lighthouse vessels:	
1913.....	59.00
1914.....	34,442.22
1915.....	955,993.82
Salaries Lighthouse Service:	
1914.....	4,045.00
1915.....	359,140.73
General expenses, Lighthouse Service:	
1913.....	19,267.52
1914.....	448,890.85
1915.....	2,312,180.90
Certified claims.....	221.19
Total maintenance.....	<u>5,111,120.94</u>

SPECIAL WORKS.

General:

Tender for first lighthouse district.....	38,767.12
Tender for fifteenth lighthouse district.....	20,780.22
Light vessels for general service.....	28,703.07
Lighthouse tender, general service.....	652.80
Oil houses for light stations.....	1,559.93
Light keepers' dwellings.....	2,237.58
Relief of employees of the Lighthouse Service.....	331.70
Claims for damages by collision with lighthouse vessels.....	6,648.11
Second district:	
Cape Cod Canal Lights, Mass.....	23,784.45
Third district:	
Staten Island and West Bank Light Stations, N. Y.....	274.35
Staten Island lighthouse depot, N. Y. (wharves).....	10,707.07
Negro Point Light Station, N. Y.....	322.87
Newark Bay beacon lights, N. J.....	33.25
Rondout Creek Light Station, N. Y.....	21,565.25
Point Judith Breakwater Lights, R. I.....	1,840.20
Repairs to lighthouse tender <i>Pansy</i>	4,332.00
Fourth district:	
Miah Maull Shoal Light Station, Delaware River.....	871.73
Brandywine Shoal Light Station, Del.....	31,291.14
Fifth district:	
Thimble Shoal Light Station, Va.....	47,687.29
Chesapeake Bay lighted buoys.....	3,595.44
Lighting Norfolk Harbor, Va.....	1,097.40
Fort McHenry Channel range lights, Md.....	49,416.90
Sixth district:	
Cape Fear River lights, N. C.....	1,062.32
Tender for engineer, sixth lighthouse district.....	435.67
Depot for sixth lighthouse district.....	60,774.48

Eighth district:	
Galveston Jetty Light Station, Tex.....	\$6, 735. 55
Southwest Pass Light Vessel, Mississippi River.....	1, 485. 59
Aids to navigation, Atchafalaya Entrance Channel, La.....	2, 682. 47
Ninth district: San Juan lighthouse depot, P. R.....	
1, 999. 37	
Tenth district:	
Buffalo Breakwater Light Station, N. Y.....	6, 692. 25
Point Abino Light Vessel, Lake Erie.....	9, 859. 53
Cleveland Fog-Signal Station, Ohio.....	203. 92
Aids to navigation, Ashtabula Harbor, Ohio.....	8, 605. 85
Aids to navigation, Lorain Harbor, Ohio.....	1, 331. 95
Eleventh district:	
Aids to navigation, St. Marys River, Mich.....	3, 610. 41
Aids to navigation, Ashland, Wis.....	17, 606. 41
Detroit River lights, Mich.....	18, 862. 98
Superior Pierhead Range Lights, Wis.....	3, 332. 55
Twelfth district:	
Oconto Harbor lights, Wis.....	2, 059. 37
Milwaukee Light Vessel, Wis.....	406. 07
White Shoal Light Station, Lake Michigan.....	516. 49
Aids to navigation, Manistique, Mich.....	7, 420. 97
Sixteenth district:	
Aids to navigation, Alaska.....	23, 061. 36
Lincoln Rock Light Station, Alaska.....	15. 59
Cape St. Elias Light Station, Alaska.....	12, 010. 49
Seventeenth district:	
Warrior Rock Light Station, Oreg.....	2, 000. 00
Aids to navigation, Puget Sound, Wash.....	6, 322. 45
Eighteenth district: Point Arena Light Station, Cal.....	
1, 582. 43	
Nineteenth district: Kauai Island Light Station, Hawaii.....	
3, 339. 41	
Total, special works.....	
500, 515. 80	
Total, maintenance appropriations.....	
5, 111, 120. 94	
Total, special works.....	
500, 515. 80	
Grand total.....	
5, 611, 636. 74	

ITEMIZED ESTIMATES OF APPROPRIATIONS FOR THE FISCAL YEAR 1917, AND ITEMIZED STATEMENT OF EXPENDITURES FOR THE FISCAL YEAR 1915, AS REQUIRED BY THE ACT OF CONGRESS APPROVED JUNE 25, 1910 (36 STAT., 755).

[The expenditures herein stated are in part estimated, owing to the fact that all obligations incurred for the year 1915 have not yet been settled. Articles of supplies purchased for general stock have also been distributed, approximately, to features to be benefited. This table refers to appropriations made in the sundry civil appropriation act and does not include Bureau salaries in Washington nor the cost of publications, otherwise provided for.]

Item.	Estimate, 1917.	Expenditures, 1915.	Item.	Estimate, 1917.	Expenditures, 1915.
GENERAL EXPENSES, LIGHTHOUSE SERVICE.			GENERAL EXPENSES, LIGHTHOUSE SERVICE—contd.		
Lights and fog signals:			Offices—Continued.		
Rations and provisions.....	\$161,000	\$160,817	Telegraph and telephone...	\$7,500	\$7,689
Fuel and rent for keepers...	53,000	52,179	Traveling expenses and mileage.....	35,000	35,255
General supplies.....	208,000	205,217	Rent.....	6,000	5,661
Repairs and improvements, including grounds and outbuildings.....	346,000	342,377	Freight, expressage, and cartage.....	30,000	28,258
Establishing lights and fog signals, including sites....	65,000	65,001	Motor cycle, Hawaiian Islands.....	300	
Necessary additional land for light stations.....	1,500	50	Incidental expenses.....	4,000	4,105
Oil and carbide houses.....	2,000	157	Total.....	2,840,000	2,766,249
Incidental expenses.....	8,000	7,712	Appropriation, 1916, \$2,775,000.		
Daymarks and spindles:			Appropriation, 1915, 2,775,000.		
Establishment, including sites.....	3,000	2,575	SALARIES OF KEEPERS OF LIGHTHOUSES.		
Repairs and improvements.	9,000	8,400	Salaries of lighthouse keepers.....	940,000	907,031
Incidental expenses.....	250	253	Appropriation, 1916, \$940,000.		
Post lights:			Appropriation, 1915, 940,000.		
Establishment.....	8,000	6,165	SALARIES, LIGHTHOUSE VESSELS.		
Wages of laborers attending lights.....	235,000	233,610	Salaries and wages, lighthouse tenders.....	721,315	633,332
Supplies.....	20,000	19,410	Salaries and wages, light vessels.....	378,655	347,819
Repairs and improvements.	15,000	13,932	Total.....	1,100,000	981,151
Incidental expenses.....	1,000	989	Appropriation, 1916, \$1,010,000.		
Buoys:			Appropriation, 1915, 997,600.		
Establishment.....	150,000	149,417	SALARIES, LIGHTHOUSE SERVICE.		
Supplies.....	31,000	31,042	Salaries, executive and technical.....	150,000	134,392
Repairs.....	47,000	45,806	Salaries, clerical and messenger.....	144,000	131,423
Incidental expenses.....	750	675	Salaries, authorized depot force.....	168,000	99,741
Tenders:			Total.....	362,000	365,556
Rations and provisions.....	210,000	204,879	Appropriation, 1916, \$675,000.		
Supplies.....	365,000	352,000	Appropriation, 1915, 375,000.		
Repairs.....	205,000	167,000			
Incidental expenses.....	10,000	10,073			
Light vessels:					
Rations and provisions.....	95,000	90,560			
Supplies.....	115,000	113,821			
Repairs.....	165,000	174,875			
Incidental expenses.....	2,800	2,768			
Depots:					
Pay of laborers and mechanics.....	57,000	55,895			
Rent.....	5,500	5,040			
Repairs and improvements.	138,000	138,054			
Incidental expenses.....	10,000	10,884			
Offices:					
Technical books and periodicals.....	400	290			
Stationery and office supplies.....	14,000	13,358			

SUMMARY OF ESTIMATES OF APPROPRIATIONS FOR THE LIGHTHOUSE SERVICE FOR THE FISCAL YEAR 1917.

FOR GENERAL MAINTENANCE OF THE LIGHTHOUSE SERVICE.

Salaries, Bureau of Lighthouses.....	\$67, 230
General expenses, Lighthouse Service.....	2, 840, 000
Salaries, Lighthouse Service.....	394, 600
Salaries, keepers of lighthouses.....	940, 000
Salaries, lighthouse vessels.....	1, 100, 000
Total.....	5, 341, 830

FOR SPECIAL WORKS.

Group 1. Works urgently necessary for the safety of navigation and for the preservation of existing structures or equipment, for the full utilization of other public improvements, or for the completion of projects already commenced:

1. Point Vicente, Cal., establishment of light and fog-signal station.....	\$80, 000
2. St. Johns River, Fla., aids to navigation.....	66, 000
3. Woods Hole, Mass., improvements to lighthouse depot.....	50, 000
4. Fighting Island Channel, Mich., aids to navigation.....	25, 000
5. Guantanamo, Cuba, building keepers' dwelling and improving the lighting.....	14, 000
6. Florida Reefs, Fla., aids to navigation.....	75, 000
7. Hudson River, N. Y., aids to navigation.....	100, 000
8. Mississippi River, La., aids to navigation.....	50, 000
9. Conneaut, Ohio, light and fog signal, and improving present aids to navigation.....	63, 500
10. Kellett Bluff, Wash., establishment of light and fog signal station..	40, 000
11. Coquille River, Oreg., aids to navigation.....	6, 000
12. Toledo Harbor, Ohio, aids to navigation.....	15, 000
13. Pearl Harbor, Hawaii, aids to navigation.....	80, 000
14. Dog Island, Me., establishment of light.....	3, 500
15. Sandy Hook, N. J., aids to navigation.....	20, 000
16. Delaware River, Pa. and Del., aids to navigation.....	80, 000
17. Tender and barge for eighth lighthouse district, construction and equipment.....	20, 000
18. Lighthouse tender to replace tender <i>Gardenia</i> , or for general service.	150, 000
19. Light vessel for Cape Charles, Va., or for general service.....	130, 000
20. Light vessels for general lakes service.....	150, 000
Total group 1.....	1, 218, 000

Group 2. Works considered essential for the immediate needs of navigation and for the efficient equipment of the Lighthouse Service:

21. Lighthouse depot for second district, construction.....	85, 000
22. Detroit, Mich., improvements to lighthouse depot.....	53, 000
23. Staten Island lighthouse depot, N. Y., improvement.....	21, 000
24. Huron Harbor, Ohio, aids to navigation.....	4, 500
25. Hawaiian Islands lighthouse depot, temporary structure.....	5, 000
26. Hawaiian Islands lighthouse depot, construction and equipment..	90, 000
27. Point Borinquen Light Station, P. R., removal and rebuilding...	85, 000
28. Light keepers' dwellings, construction.....	75, 000
29. Fairport, Ohio, aids to navigation.....	42, 000
30. Sand Hills, Mich., establishment of light and fog-signal station...	75, 000
31. Manitowoc Breakwater Light Station, Wis., improvement.....	21, 000
32. East River, N. Y., aids to navigation.....	16, 000
33. Keweenaw Waterway, Mich., aids to navigation.....	110, 000
34. Cape Charles City, Va., aids to navigation.....	12, 800
35. Chesapeake Bay and tributaries, Md. and Va., Eastern Shore, aids to navigation.....	29, 000
36. Alaska, aids to navigation.....	60, 000
Total group 2.....	784, 300

Group 3. Works considered essential for the needs of navigation and the equipment of the Lighthouse Service, and which it is recommended be undertaken as resources permit, are submitted with estimates of cost. (These items have been selected from a much larger number of recommendations submitted by the inspectors of the lighthouse districts and others.)

37. Ludington, Mich., aids to navigation.....	\$35,000
38. Tampa Bay, Fla., aids to navigation.....	12,000
39. Delaware Bay entrance, improvement of aids to navigation.....	75,000
40. Goose Island Flats, N. J., establishment of light and fog-signal station.....	120,000
41. Alaska, lighthouse depot, purchase of site and construction and equipment.....	50,000
42. Indian River, Fla., aids to navigation.....	8,500
43. Light vessel for South Pass, La., or for general service.....	125,000
44. Sand Island Light Station, Ala., improvements.....	45,000
45. Point Pinos Light Station, Cal., improvement.....	29,000
46. Spectacle Reef Light Station, Mich., improvements.....	20,000
47. Michigan Island, Wis., establishment of light and fog-signal station.....	100,000
48. Kauhola Point Light Station, Hawaii, improvement.....	19,000
49. Goat Island Lighthouse depot, Cal., improvements.....	51,000
50. Santa Barbara Light Station, Cal., improvements.....	29,000
51. Cape Spencer, Alaska, establishment of light and fog-signal station.....	100,000
52. Potomac River, Md., aids to navigation.....	120,000
53. Lighthouse depot for fifth district, enlargement, improvement, or establishment of new depot.....	275,000
54. Lighthouse tender, to replace tender <i>John Rodgers</i> , or for general service.....	150,000
55. Additional gas buoys, fifth lighthouse district.....	35,000
56. Chicago Harbor Light Station, Ill., removing and rebuilding.....	142,000
57. Cape Fear Light Station, N. C., removing and rebuilding, or protection.....	35,000
58. Hilo, Hawaii, aids to navigation.....	13,000
59. Portage Lake, Mich., establishment of light and fog-signal station and improvement of aids.....	100,000
60. Ram Island, Me., establishment of light.....	3,100
61. Cape Kumukahi, Hawaii, establishment of light.....	22,000
62. Washington and Oregon, aids to navigation.....	35,000
63. Henderson Point, Me., establishment of light and fog signal.....	3,800
64. Port Real, P. R., establishment of light station.....	34,000
65. Nine Mile Point, Mich., establishment of light and fog-signal station.....	50,000
66. Anacapa Island, Cal., establishment of light and fog-signal station..	103,000
67. Caribbean Sea, aids to navigation.....	60,000
Total, group 3 (not included in total of estimates).....	<u>1,999,400</u>

RECAPITULATION.

For general maintenance of the Lighthouse Service.....	5,341,830
For special works:	
Group 1.....	\$1,218,000
Group 2.....	784,300
	<u>2,002,300</u>
Grand total.....	<u>7,344,130</u>

DETAILED ESTIMATES FOR MAINTENANCE, 1917.

BUREAU OF LIGHTHOUSES.

Salaries.....	\$67,230
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GENERAL EXPENSES, LIGHTHOUSE SERVICE.

For supplies, repairs, maintenance, and incidental expenses of lighthouses and other lights, beacons, buoyage, fog signals, lighting of rivers heretofore authorized to be lighted, light vessels, other aids to navigation, and lighthouse tenders, including

the establishment, repair, and improvement of beacons and day marks and purchase of land for same; the establishment of post lights, buoys, submarine signals, and fog signals; the establishment of oil or carbide houses not to exceed \$10,000: *Provided*, That any oil or carbide house erected hereunder shall not exceed \$550 in cost; the construction of necessary outbuildings at a cost not exceeding \$500 at any one light station in any fiscal year; the improvements of grounds and buildings connected with light stations and depots; wages of laborers attending post lights; pay of temporary employees and field force while engaged on works of general repair and maintenance and pay of laborers and mechanics at lighthouse depots; rations and provisions or commutation thereof for keepers of lighthouses, working parties in the field, officers and crews of light vessels and tenders, and officials and other authorized persons of the Lighthouse Service on duty on board of such tenders or vessels; and money accruing from commutation for rations and provisions for the above-named persons on board of tenders and light vessels or in working parties in the field may be paid on proper vouchers to the person having charge of the mess of such vessels or parties; reimbursement under rules prescribed by the Secretary of Commerce of keepers of light stations and masters of light vessels and of lighthouse tenders for rations and provisions and clothing furnished shipwrecked persons who may be temporarily provided for by them, not exceeding in all \$5,000 in any fiscal year; fuel and rent of quarters where necessary for keepers of lighthouses; the purchase of land sites for fog signals; the rent of necessary ground for all such lights and beacons as are for temporary use or to mark changeable channels and which in consequence can not be made permanent; the rent of offices, depots, and wharves; traveling expenses, including per diem in lieu of subsistence allowed pursuant to section 13 of the sundry civil appropriation act approved August 1, 1914, mileage, library books for light stations and vessels, and technical books and periodicals not exceeding \$1,000; and for all other contingent expenses of district offices and depots and for contingent expenses of the Office of the Bureau of Lighthouses in Washington, \$2,840,000.

Hereafter the Secretary of Commerce is authorized, whenever he shall deem it advisable, to exchange any right of way of the United States in connection with lands pertaining to the Lighthouse Service for such other right of way as may be advantageous to the Service, under such terms and conditions as he may deem to be for the best interests of the Government; and in case any expenses are incurred by the United States in making such exchange, the same shall be payable from the appropriation "General expenses, Lighthouse Service," for the fiscal year during which such exchange shall be effected.

Hereafter post-lantern lights and other aids to navigation may be established and maintained, in the discretion of the Commissioner of Lighthouses, out of the annual appropriations for the Lighthouse Service on the Mobile, Tombigbee, Warrior, and Black Warrior Rivers, Alabama.

Hereafter the appropriation "General expenses, Lighthouse Service" shall be available for the purchase, equipment, repair, and operation of motor-propelled vehicles for transporting passengers or freight for use of the Lighthouse Service in the Hawaiian Islands.

Hereafter light keepers and assistant light keepers of the Lighthouse Service shall be entitled to medical relief without charge at hospitals and other stations of the Public Health Service, under the rules and regulations governing the care of seamen of the merchant marine: *Provided further*, That this benefit shall not apply to any keeper or assistant keeper, who receives an original appointment after the passage of this act, unless the applicant passes a physical examination in accordance with rules approved by the Secretary of Commerce and the Secretary of the Treasury.

NOTE.—The amount estimated for is \$65,000 in excess of the appropriation for the fiscal year 1916, consisting of the following items:

Leave of absence for per diem employees.....	\$15,000
General increase of service.....	50,000
Total.....	65,000

The item of \$15,000 for leave of absence of per diem employees is made necessary by the authority contained in the act of March 3, 1915 (38 Stat., 927). The granting of this leave is believed to be of benefit to both the employees and the Lighthouse Service, but in order that the work of the Service may not be delayed, it is necessary to provide funds to meet this expense.

The further increase of \$50,000 is considered necessary on account of the increase in numbers of aids required for the safety of navigation and to keep the Lighthouse Service in an economical state of repair and efficiency. This increase of \$50,000 is 1.8 per cent over the appropriation of the last two years, while the total number of aids was increased during the same period from 13,521 to 14,544, an increase of 1,023

or 7.5 per cent. In order to keep pace with the constant development of commerce it is believed that proper provision for maintenance and repair as well as for the establishment of necessary additional minor aids frequently requested by mariners should be made. With the increasing numbers of requests for aids, it is impossible to render the full efficiency and service demanded unless adequate provision is made for funds.

The foregoing estimate of appropriation for "General expenses, Lighthouse Service," provides for the increase in the limit of cost of construction of necessary outbuildings at light stations in any fiscal year from \$200 to \$500. The limit of cost of \$200 authorized for this purpose has been contained in appropriation acts since the fiscal year 1902, since which time the cost of labor and materials has greatly increased. The effect of restriction to this small limit has been to cause the erection of numerous small unsubstantial buildings at light stations, making the premises unsightly, rather than a smaller number of larger and better structures at a greater cost per building. It is not anticipated that there will be any increase in the total expenditure for this purpose, and the more permanent type of structure possible with a higher limit of cost will prove economical as well as improve the appearance of light stations.

Provision is also included for allowing commutation of rations and provisions to working parties of the Lighthouse Service in the field. The members of working parties of the Lighthouse Service are furnished their subsistence when employed away from their homes and stations, but there is no authority for commuting the allowance, it being necessary either to provide subsistence in kind or reimburse the individuals for expenditures made by them for this purpose. It will facilitate the work of subsisting field parties and reduce the amount of clerical work in district offices if authority for commuting this subsistence is granted.

Regarding the proposed legislation for exchanges of rights of way, it is desirable from time to time for the best interests of the Lighthouse Service to exchange existing rights of way over land leading to lighthouse reservations for more direct or suitable rights of way; but there is no existing law authorizing such changes, which it is now recommended that Congress grant in the authority requested above.

In connection with the estimate of appropriation submitted herewith authority is requested to establish and maintain post-lantern lights and other aids to navigation on the Mobile, Tombigbee, Warrior, and Black Warrior Rivers, Ala. The lighting of rivers or inland waters is limited to those specifically authorized by Congress, and such authority has not been granted for the waters herein specified. These rivers have been extensively improved by the building of locks under the War Department and an increasing commerce, principally of barges carrying coal, has been developed. Maritime interests in these localities have urged the establishment of aids, and investigation by the Lighthouse Service has shown that such action is warranted.

Authority is also requested for making the appropriation, "General expenses, Lighthouse Service" available for the purchase, equipment, repair, and operation of motor-propelled vehicles for carrying passengers or freight in the Hawaiian Islands. On account of the prohibition contained in the act of August 1, 1914 (38 Stat., 508), there is no appropriation available for this purpose. Except in the vicinity of Honolulu, travel in those islands is almost exclusively by automobile and on account of the long distances the expense is very high. It is desired to purchase a motorcycle for the use of foremen and other employees in connection with construction and repair work of the Service, which will effect a material saving in transportation expense and in the time of the employees.

Authority is also requested for extending the benefits of the Public Health Service to lighthouse keepers and assistant lighthouse keepers. The employees in question are mostly employed at isolated places and in many cases their compensation is such as to make it a hardship for them to bear the expense of illness or injury. There is already provision for the care and treatment by the Public Health Service of officers and crews of vessels of the Lighthouse Service, without charge, and it is considered just that the other employees named herein be given the same benefits. The proposed legislation has the approval of the Secretary of the Treasury.

It is further recommended that consideration be given to the consolidation of the four general maintenance appropriations under the single appropriation "General expenses," by naming in the consolidated general appropriation a specific amount as the limit of all salary items included therein. It is believed that this step would effect a more economical and efficient administration of the Lighthouse Service by simplification of the accounting system, and permitting the costs of work to be kept in a more systematic and comprehensive manner, showing clearly for each principal feature the relative amounts paid for salaries, materials, supplies, equipment, and other component items. Among additional advantages of consolidation of items of general appropriation may be stated the following: (a) Laborers in charge of lights are now paid out of two different appropriations, those attending lights on rivers

authorized by Congress to be lighted being paid out of general expenses, and those at other lights not on rivers being paid out of salaries of keepers; (b) commutation of rations of keepers and other employees (which may be properly considered as part of their compensation) now must be paid out of the appropriation "General expenses," while the salaries proper are paid out of the respective salary appropriations; (c) the items recommended for consolidation have natural limitations. For example, the number and average salary of keepers is limited by law. A necessary limitation is also imposed by the number of vessels in service. If such a consolidation of appropriations may be effected, it is believed that the total sum of the four general maintenance appropriations stated in these estimates, viz, \$5,274,600, may be reduced in the sum of \$25,000 to a revised total of \$5,249,600. This may be effected by reason of the fact that it is necessary to allow a small portion of each appropriation to be reserved for prevention of a deficiency prohibited by law, and if the appropriations be consolidated the amount reserved may be correspondingly reduced.

(See p. 71 for itemized estimate.)

SALARIES, KEEPERS OF LIGHTHOUSES.

For salaries of not exceeding 1,800 lighthouse and fog-signal keepers and laborers attending other lights, exclusive of post lights, \$940,000.

NOTE.—This is the same amount as appropriated for the fiscal year 1916.

(See p. 71 for itemized estimate.)

SALARIES, LIGHTHOUSE VESSELS.

For salaries and wages of officers and crews of light vessels and lighthouse tenders, including temporary employment when necessary, \$1,100,000.

NOTE.—The amount estimated for is \$90,000 in excess of the appropriation for the fiscal year 1916, as per the following statement:

Present authorized complements of tenders.....	\$675,930	
Present authorized complements of light vessels.....	365,316	
		\$1,041,246
Complements of new tenders, fiscal year 1917.....	43,570	
Complements of new light vessels, fiscal year 1917.....	15,760	
		59,330
Radio operators on tenders.....		7,720
		1,108,296
Estimated lapsed pay.....		8,296
Total estimated for.....		1,100,000

The appropriation under this head for 1916 was \$1,010,000, which is \$31,246 less than the total of the present authorized complements on the vessels, so that in order to avoid a deficiency it will be necessary to lay up some vessels or reduce the crews. Similar conditions existed in the fiscal year 1915. It is therefore necessary to ask for a larger appropriation in order to keep all vessels in commission and maintain the efficiency of the Service. During the fiscal year 1917 it is expected that there will be in commission three new tenders and four new light vessels, in addition to those in service during the year 1915, for a whole or part of the year, for which a total of \$59,330 for salaries and wages will be required, based on complements of similar vessels now in service.

The item of \$7,720 for radio operators is intended to provide for the additional employees required for installations on lighthouse tenders. Three installations are already completed, for which there are not sufficient funds to provide operators, and 5 other installations are to follow as funds become available. The moderate installation of such equipment is believed to be an urgent matter for the best efficiency of the Service.

(See p. 71 for itemized estimate.)

SALARIES, LIGHTHOUSE SERVICE.

For salaries of 17 lighthouse inspectors, and of clerks and other authorized permanent employees in the district offices and depots of the Lighthouse Service, exclusive of those regularly employed in the office of the Bureau of Lighthouses, Washington, D. C., \$394,600. Hereafter the annual salaries of lighthouse inspectors, excepting the inspector of the third lighthouse district, shall not exceed \$3,000 each.

NOTE.—An increase of \$19,600 over the appropriation for the fiscal year 1916 is submitted, consisting of the following:

Additional clerks and draftsmen.....	\$10,000
Increase of salary for lighthouse inspectors.....	9,600
Total.....	19,600

The item of \$10,000 is occasioned by the general growth of the Service in order that the technical and clerical work of the district offices may be dispatched promptly. About 10 positions at salaries ranging from \$900 to \$1,500 per annum will be thus provided for.

The salaries of lighthouse inspectors are, by the act of June 17, 1910, limited to \$2,400 a year, except the inspector of the third district, whose salary is fixed at \$3,600. The salary of \$2,400 is inadequate because of the heavy responsibilities with which the inspectors are charged and the technical and business ability required to successfully discharge the duties. The compensation of these positions should be sufficient to bring into and retain in the Lighthouse Service a class of persons fully competent to efficiently conduct such important work. The inspectors should be men of high character and qualifications, including technical knowledge as to engineering and nautical affairs, and business ability. The salaries of lighthouse inspectors are materially less than those of various other officers of the Government whose requirements and responsibilities are not considered to be any greater.

(See p. 71 for itemized estimate.)

DETAILED ESTIMATES FOR SPECIAL WORKS, 1917.

GROUP No. 1.

Works urgently necessary for the safety of navigation and for the preservation of existing structures or equipment, for the full utilization of other public improvements, or for the completion of projects already commenced.

No. 1. *Point Vincente, Cal., Light Station.*—For establishing a light and fog-signal station at Point Vincente, Cal., \$80,000.

NOTE.—The act of March 3, 1915 (38 Stat., 927), authorized this work, but no appropriation was made therefor. Point Vincente is the most prominent point of the California shore line between Point Loma and Point Conception, a distance of 220 nautical miles. Practically all steamer traffic on the Pacific coast south of San Francisco, both domestic and foreign, passes this point. There is at present no lighthouse on this point, but there is one at Point Fermin, 6½ miles southeastward. This point, however, is cut off from steamers approaching on the usual courses from the northward until within 4 miles of Point Vincente by that point itself. This leaves an unlighted gap of 32 nautical miles on the usual courses of coasting vessels between Point Hueneme Light Station and Point Fermin Light Station. The Point Fermin light would be discontinued on the completing of this proposed light station, for the reason that with a light on Point Vincente and the new lighthouse at the entrance to Los Angeles Harbor it would be no longer required. Freight and passenger traffic is very heavy along this part of the coast and will be materially increased with the opening of the Panama Canal. Point Vincente is a bold, rocky point and practically no warning can be had by the lead in approaching it in foggy weather, as the 100-fathom curve lies within one-half mile of the shore. The importance of this point is increased by the fact that it is a point of change of course for all passing traffic. Petitions dated September 21, 1907, September 3, 1909, and October 28, 1909, signed by masters and shipowners, requested that a light and fog signal be established at this point. It is proposed to establish a flashing light at an elevation of 170 feet, and a first-class compressed-air fog signal. Detailed estimate:

Tower, including site and water supply.....	\$31,000
Illuminating apparatus.....	5,500
Fog-signal apparatus and building.....	9,800
Dwellings for three keepers.....	19,000
Outbuildings, fences, oil storage, piping, etc.....	7,000
Contingencies.....	7,700
Total.....	80,000

No. 2. *St. Johns River, Fla., aids to navigation.*—For improving the aids to navigation and establishing new aids on the St. Johns River, Fla., below Jacksonville, \$66,000.

NOTE.—The act of March 3, 1915 (38 Stat., 926), authorized this work, but no appropriation was made therefor. The present project of the United States engineers calls for a 30-foot low-water channel from the sea to Jacksonville, and is expected to be completed by July 1, 1915. The increased depth in this river means that vessels of increased size will use this port. It will, moreover, be more than ever necessary to follow the dredged channels closely. The present post lights along the edges of the channels, already a source of much trouble and expense on account of damage by collision, if retained, would have to be moved even closer to the channels and into depths of water in which it would prove impracticable to maintain them. The present post-lantern lights are confusing by reason of their low intensity and fixed characteristic, and the large number of them necessarily visible at one time. The amount of commerce on this river is large and increasing and fully warrants any reasonable expenditure to establish an efficient system of lighted aids. It is proposed to establish 36 range lights, 14 post lights, and 21 buoys to mark this tortuous channel properly. Detailed estimate:

Foundations for 36 range lights.....	\$14,400
Towers for same.....	3,600
Illuminating apparatus.....	22,000
14 post-light structures.....	1,400
16 gas buoys and appendages.....	21,600
5 nun buoys and appendages.....	1,000
Contingencies.....	2,000
Total.....	66,000

No. 3. *Woods Hole, Mass., lighthouse depot.*—For improvements at Woods Hole lighthouse depot, Mass., \$50,000.

NOTE.—The act of March 3, 1915 (38 Stat., 926), authorized this work, but no appropriation was made therefor. This depot is well located and protected in all weathers, but the work is badly handicapped by there not being a sufficient depth of water for tenders and deep-draft light vessels. It is recommended that the channel and basin around the wharf be dredged to a depth of 17 feet at low water, and it is also recommended that a brick storehouse, 35 by 80 feet, two stories high, with a half-pitch roof be built to replace the wooden one, which is not at all adapted for the work, and not large enough to accommodate the stock on hand in proper manner. Under present conditions the tender *Anemone* requires a supply of buoys on the fish commission dock and on the wharf at New Bedford, thus having the supplies located in three different places. The *Azalea* is required to tend and wait on the *Anemone* when anything is required from the depot's stock. This operation seriously interferes with carrying on the work properly. The dock at the fish commission is in a very dilapidated condition, and it is only a matter of a short time when the *Anemone* will not be able to dock there or keep a working supply of buoys and appendages. The front of the wharf has already been taken away and the remainder will not last for any great length of time. Detailed estimate:

Dredging channel.....	\$35,000
Building storehouse.....	15,000
Total.....	50,000

No. 4. *Fighting Island Channel, Mich., aids to navigation.*—For improving aids to navigation and establishing new aids in the Fighting Island Channel, Detroit River, Mich., \$25,000.

NOTE.—The act of March 3, 1915 (38 Stat., 927), authorized this work, but no appropriation was made therefor. The project for improvement of the lower Detroit River, contained in House Document No. 17, Sixty-second Congress, first session, for which an appropriation was made in the river and harbor act of March 4, 1913, is now in course of completion. This contemplates a straight channel after leaving the Grassy Island North Channel Range to the turn on to the Grosse Isle South Channel Range, a distance of some 5 miles. This will eliminate the necessity of both Mamajuda Range and Grassy Island South Channel Range, and necessitate the moving of both Ecorse Range, at the north end, and Grosse Isle North Channel Range, at the south, to proper sailing lines in the new channel.

The preferred scheme of lighting would be the establishment of separate ranges for up and down bound vessels, and of two or more side lights at about the present locations, on the west side of Grassy Island South and Mamajuda Ranges. Detailed estimate:

Establishing new range lights.....	\$15,000
Moving present range lights.....	5,000
Establishing side channel lights.....	5,000
Total.....	25,000

No. 5. *Guantanamo, Cuba, aids to navigation.*—For dwelling for keepers of the lights in Guantanamo Bay, Cuba, and improving the lighting, \$14,000.

NOTE.—The act of July 27, 1912 (37 Stats., 239), authorized the construction of these works, but no appropriation was made therefor. The dwelling at this station was destroyed during the late insurrection, and since the occupation of Guantanamo by the United States the keepers have been compelled to live in a wooden shack with only three rooms to house three keepers. The lights in charge of these three keepers are widely separated. With the installation of acetylene lights as proposed, the service of one keeper may be dispensed with. Detailed estimate:

Dwelling for two keepers.....	\$8,000
2 acetylene lights at Fisherman Point.....	2,800
2 acetylene lights at Hicacal Beach.....	2,800
Contingencies.....	400
Total.....	14,000

No. 6. *Florida Reefs, Fla., aids to navigation.*—For establishing additional lighted aids for Florida Reefs, and repairs and improvements to existing aids, \$75,000.

NOTE.—The act of March 3, 1915 (38 Stat., 926), authorized this work, but no appropriation was made therefor. On account of the unusually difficult and dangerous conditions encountered by vessels navigating near the Florida Reefs, especially by vessels bound into the Gulf of Mexico, which pass close to the reef to avoid the adverse Gulf stream current, additional lighted aids are urgently needed. A very large commerce is carried on through the Straits of Florida and numerous strandings and wrecks, involving large losses, have occurred in the past, several within the last year. These reefs, owing to their nature, are a grave danger to navigation. They rise steeply from the deep channel of the Straits of Florida and the lead is, therefore, of little assistance. They lie far from shore, and at night the mariner must rely almost entirely upon artificial aids to guide him clear. It is, therefore, proposed to provide four intermediate lighted aids to be located about midway between present lights, which it is believed would greatly decrease the present dangers of navigation in that vicinity. Detailed estimate:

Skeleton towers in place, Molasses Reef and Pacific Reef, with iron-pile foundations.....	\$50,000
Illuminating apparatus for Molasses Reef and Pacific Reef.....	10,000
Gas buoys for Coffins Patches and Looe Key.....	10,000
Repairs and improvements to existing aids.....	5,000
Total.....	75,000

No. 7. *Hudson River, N. Y., aids to navigation.*—For improving the aids to navigation and establishing new aids on the Hudson River, N. Y., \$100,000.

NOTE.—The act of March 3, 1915 (38 Stat., 926), authorized this work, but no appropriation was made therefor. The lighting on the river is obsolete and many of the existing aids are in poor condition from age and so constructed that it is impossible to keep them in operation when the ice commences to move, and, as navigation is frequently open for a month in the fall of the year under these conditions, it is a great inconvenience and danger to navigation. Many complaints have been received from pilots and officials of Hudson River steamers, and correspondence with them has indicated a number of points at which improvements or new aids are considered necessary. With the large amount of traffic on this river and the size of passenger steamers navigating it at night, it is believed that a modern system of flashing lights, on concrete foundations so as to resist ice damage, would be of great assistance to navigation. It is proposed to rebuild the light and fog signal at Stony Point, which is in poor condition and far from the edge of the channel, to improve existing aids at Staats Point, Lamphere Dock, Four Mile Point, West Flats, and Con Hook, by providing brighter and flashing lights, to increase candlepower and provide fog bell at Jeffreys Hook, to rebuild decayed foundations and provide new towers and brighter lights at Bear Island, Cow Island, Nine Mile Tree, Roha Hook, Five Hook Island, New Baltimore, Fitch's Wharf, Percy Reach, Catskill West Flats, Livingston Creek, Upper Coal Beds, and Esopus Island, to rebuild tower and fog-bell house and improve the light at West Point, and to establish new lights at Van Wies Point, Barrytown Bluffs, Magazine Point, and Anthony's Nose, improving in all 20 existing lights and establishing 4 new lights. The cost of providing and moving suitable construction plant has also been included. Detailed estimate:

Rebuilding Stony Point.....	\$15,000
Improving Staats Point, etc., 5 lights, at \$2,500.....	12,500
Improving Jeffreys Hook with fog bell.....	5,500
Rebuilding and improving Bear Island, etc., 12 lights, at \$3,000.....	36,000
Rebuilding and improving West Point.....	6,000
Establishing Van Wies Point, etc., 4 lights, at \$4,000.....	16,000
Contingencies.....	9,000
Total	100,000

No. 8. *Mississippi River, La., aids to navigation.*—For improving the aids to navigation and establishing new aids on the Mississippi River, below New Orleans, La., \$50,000.

NOTE.—The act of March 3, 1915 (38 Stat., 926), authorized this work, but no appropriation was made therefor. It is proposed to establish about 22 acetylene lens-lantern lights on skeleton steel towers, to take the place of the inefficient oil post-lantern lights now shown from wooden posts. Vessels traverse the river, drawing 28 feet of water. The commerce of the river is large and important. From January 1 to December 31, 1913, 3,662 coastwise and foreign-bound vessels, with a tonnage of approximately 8,140,000, entered the port of New Orleans. The imports and incoming coastwise shipments during 1913 were valued at approximately \$101,000,000, and the exports and outgoing shipments approximately \$213,000,000, making a total value of \$314,000,000. Detailed estimate:

22 ramps and foundations.....	\$12,000
22 steel towers, 30 feet high.....	9,000
22 illuminating outfits.....	25,000
Contingencies.....	4,000
Total.....	50,000

No. 9. *Conneaut, Ohio, aids to navigation.*—For a light and fog signal and improving the present aids to navigation in Conneaut Harbor, Ohio, \$63,500.

NOTE.—The act of March 3, 1915 (38 Stat., 926), authorized this work, but no appropriation was made therefor. Extensive improvements to enlarge this harbor, involving the construction of new breakwaters and pierheads, and the removal of the breakwater pierhead upon which the present Conneaut Harbor Front Range Light and Fog Signal is situated, have been authorized and the construction of the breakwaters is in progress. The west breakwater pierhead is under contract to be completed this season. The harbor improvement will necessitate a rearrangement of the aids to navigation and it is proposed to build a suitable structure for the main light on the pierhead, the light to be an oil vapor flashing light and the present fog bell, which is inadequate, to be replaced with a modern compressed-air siren. The commerce of Conneaut Harbor is extensive. The annual number of vessels entering and departing is about 3,000, representing a total registered tonnage of approximately 9,000,000. Detailed estimate:

Concrete base.....	\$20,000
Riprap.....	8,000
Superstructure.....	20,000
Illuminating apparatus.....	4,000
Fog-signal apparatus.....	8,000
Boats, piping, etc.....	3,500
Total.....	63,500

No. 10. *Kellett Bluff, Wash., Light Station.*—For establishing a light and fog-signal station at or near Kellett Bluff, Henry Island, Wash., or at some point on the west coast of San Juan Island, Wash., \$40,000.

NOTE.—The act of March 3, 1915 (38 Stat., 927), authorized this work, but no appropriation was made therefor. Further investigation has shown that the best location for this light is at the Lime Kiln, on the west coast of San Juan Island, Wash. The greater part of the commerce between Puget Sound and Alaska, and between Cape Flattery and points on Georgia Strait will be benefited by the establishment of a light and fog-signal station at this point. Vessels proceeding to the northward after leaving Point Wilson have a run of about 32 miles before reaching the proposed location, with no fog signal on the American side. The depths are too great for soundings and there are strong tidal currents of uncertain direction to contend with. A light and fog-signal station will provide a definite point to run for in going north

through Haro Strait, and a definite point of departure for vessels bound across the treacherous eastern end of Juan de Fuca Strait for Puget Sound, or bound northward through Haro Strait. This location is where it is customary for vessels to change course. It is important to the mariner that he verify his position here or in this vicinity in order to avoid the dangers on both sides of this narrow strait. A flashing light and a reed-horn fog signal are recommended. There is a reservation of land for lighthouse purposes on the west coast of San Juan Island. Detailed estimate:

Fog-signal building and tower.....	\$12,000
Dwellings for two keepers.....	13,000
Illuminating apparatus.....	1,000
Fog-signal apparatus.....	4,000
One derrick and hoisting engine.....	1,000
Oil house, outbuildings, boats, walks, etc.....	5,400
Contingencies.....	3,600
Total.....	40,000

No. 11. *Coquille River, Oreg., aids to navigation.*—For improvement of aids to navigation at or near the entrance to Coquille River, Oreg., \$6,000.

NOTE.—The act of March 3, 1915 (38 Stat., 927), authorized this work, but no appropriation was made therefor. Maritime interests have petitioned for the removal of the station to a more advantageous locality and much correspondence on the subject has been had during the past year. In its present location the light is of no great benefit to navigation, and the fog signal would serve its purpose better if on the other side of the river at or near the end of the south jetty. The station is on a point of land which is being encroached upon by the Coquille River. It is proposed to establish an occulting electric light and a fog bell operated by an electric motor at or near the end of the south jetty. A cottage for the keeper will be built near the inner end of the jetty on land formed by accretion since the construction of the jetty, or on a War Department reservation near by. The proposed change will effect an economy in the maintenance of the station, as only one keeper will be required instead of the present number of two. Detailed estimate:

Fog-signal building and tower.....	\$1,500
Dwelling for keeper.....	2,500
Illuminating apparatus.....	200
Fog-signal apparatus.....	800
Electric wiring and poles.....	750
Contingencies.....	250
Total.....	6,000

No. 12. *Toledo Harbor, Ohio, aids to navigation.*—For improving the aids to navigation in Toledo Harbor, Ohio, \$15,000.

NOTE.—The act of March 3, 1915 (38 Stat., 927) authorized this work, but no appropriation was made therefor. The Manhattan Range Lights, marking the axis of the Maumee Bay straight channel leading to Toledo, should be clearly visible after passing the Maumee Bay Range Lights for a distance of about 5 miles. The present lights are too low and are frequently obscured by smoke. They are also sometimes blanketed by vessels mooring in the lagoon. These lights should therefore be raised in order to give greater efficiency. The present wooden towers are not structurally adapted for raising, and it is proposed to replace them with steel towers. Detailed estimate:

Two steel towers, metal work.....	\$10,000
Foundations.....	2,000
Erection, painting, installation.....	1,500
Contingencies.....	1,500
Total.....	15,000

No. 13. *Pearl Harbor, Hawaii, aids to navigation.*—For establishing aids to navigation in Pearl Harbor, Hawaii, \$80,000.

NOTE.—The act of March 3, 1915 (38 Stat., 927), authorized this work, but no appropriation was made therefor. In view of the fact that the Government has authorized the establishment of a naval station at this point, it is important that the channels and entrance be properly marked; this is rendered more important by the set of the current, which is usually across the channel in the approach, and also on account of the prevailing northeasterly winds. The necessary aids to navigation should be available at the completion of the harbor improvements. It is proposed to establish 9 lighted and 9 unlighted beacons, also 2 gas buoys at the entrance. The Secretary of the Navy, by letter of August 12, 1913, requested favorable consideration for the establishment of suitable aids to navigation in Pearl Harbor. Detailed estimate:

2 gas lighted buoys.....	\$10,000
4 lighted beacons in exposed waters, at \$5,600.....	22,400
5 lighted beacons in unexposed waters, at \$3,500.....	17,500
2 unlighted beacons in exposed waters, at \$4,000.....	8,000
7 unlighted beacons in unexposed waters, at \$2,100.....	14,700
Contingencies.....	7,400
Total.....	80,000

No. 14. *Dog Island, Me., light.*—For establishing a light at or near Dog Island entrance to St. Croix River, Me., \$3,500.

NOTE.—The act of March 3, 1915 (38 Stat., 926), authorized this work, but no appropriation was made therefor. Several wrecks have occurred in this vicinity. The mean rise and fall of the tide is about 18 feet; and about 125,000 tons of freight are carried annually by this locality, in addition to frequent passenger service daily. It is recommended that an acetylene light with colored sector be established in the vicinity of Dog Island. Detailed estimate:

Tower, including site.....	\$2,000
Illuminating apparatus.....	1,500
Total.....	3,500

No. 15. *Sandy Hook, N. J., aids to navigation.*—For improving the aids to navigation at Sandy Hook, N. J., \$20,000.

NOTE.—The act of March 3, 1915 (38 Stat., 926), authorized this work, but no appropriation was made therefor. North Hook Beacon Light and Fog Signal, N. J., are at present so located in front of the batteries at Fort Hancock, Sandy Hook, N. J., as to interfere very seriously with the gun fire of several of the batteries, and absolutely prohibits the training of the guns on the ranges covering the entrances to New York Harbor. The matter has been carefully investigated by representatives of the War Department and of the Lighthouse Service, and the views of maritime interests obtained relative to the best methods of making the necessary changes. It is recommended that the keepers' quarters, light, and fog signal be moved to a new location out of range of the batteries. Detailed estimate:

Moving and raising light, with new foundation.....	\$7,000
Building new fog-signal house and moving engines.....	5,000
Moving, relocating, and repairing three keepers' dwellings.....	6,000
Contingencies.....	2,000
Total.....	20,000

No. 16. *Delaware River, Pa. and Del., aids to navigation.*—For improving the aids to navigation and establishing new aids on the Delaware River, Pa. and Del., \$80,000.

NOTE.—The act of March 3, 1915 (38 Stat., 926), authorized this work, but no appropriation was made therefor. The United States Engineer's Office is now dredging a new 35-foot channel in the vicinity of Schooner Ledge, Delaware River. This channel will probably be completed during the present calendar year, and will require two ranges in place of the present Schooner Ledge Range. It is proposed to mark the new ranges as follows: Chester (Upper) Range, oil-vapor rear light on present reservation, acetylene front light in the water, out of the way of heavy ice; electric fog bell to be provided at the front light; Marcus Hook (Lower) Range to be similar, except that a site will be required for the rear light and no fog bell will be needed at the front light. Detailed estimate:

Chester Rear:	
Tower on pile and concrete foundation.....	\$15,000
Removal of old and display of temporary light.....	1,000
Dwelling on pile and concrete foundation.....	8,000
Elevated walks on pile foundations.....	4,000
	\$28,000
Chester Front:	
Tower and foundation.....	9,000
Illuminating apparatus.....	2,000
Fog-signal apparatus.....	2,000
Riprap.....	2,000
	15,000
Marcus Hook Rear:	
Site and right of way.....	6,000
Tower, including dwelling.....	12,000
Illuminating apparatus.....	3,000
Oil house and outbuildings.....	1,500
Grading roads, fences, etc.....	1,500
	24,000
Marcus Hook Front:	
Tower and foundation.....	9,000
Illuminating apparatus.....	2,000
Riprap.....	2,000
	13,000
Total.....	80,000

No. 17. *Eighth lighthouse district, tender and barge.*—For constructing, or purchasing, and equipping a small tender and barge for eighth lighthouse district, Texas and Louisiana, \$20,000.

NOTE.—The act of March 3, 1915 (38 Stat., 926), authorized this work, but no appropriation was made therefor. The tender for the eighth lighthouse district, Texas and Louisiana, which should be a motor launch about 65 feet long, and barge to be equipped with derrick pile driver, neither to exceed 3 feet draft, are absolutely necessary for establishing and maintaining lights and daymarks along the intercostal canals and other shallow waters of the eighth lighthouse district. That portion of the canal from Galveston, Tex., to Corpus Christi, Tex., has been completed by the War Department, and in the next year or two the canal will be open to the Mississippi River. Detailed estimate:

Motor launch.....	\$15,000
Pile driver derrick barge.....	5,000
Total.....	20,000

No. 18. *Tender for third lighthouse district.*—For constructing, or purchasing, and equipping a lighthouse tender to replace tenders worn out in service in the third lighthouse district, or in the Lighthouse Service generally, \$150,000.

NOTE.—There are three tenders in the third district that are old and of obsolete types, and should be replaced as soon as practicable by modern efficient vessels. These are the *Gardenia*, *John Rodgers*, and *Mistletoe*. All of these tenders to be kept in commission require repairs that are not warranted by their age and the service obtained from them. At least one new tender for this district is an urgent present need.

No. 19. *Cape Charles, Va., light vessel.*—For constructing and equipping a light vessel for station off Cape Charles, Va., or for general service, \$130,000.

NOTE.—The light vessel now on Cape Charles station, which was built in 1890 and is of only 470 gross tonnage, and not self-propelling, breaks adrift from her moorings on frequent occasions, and on December 5, 1914, narrowly escaped destruction. The loss of moorings alone in the past year has amounted to over \$3,500. Owing to the exposed station and the importance of this aid to navigation, a first-class self-propelling light vessel is required. Moreover, of the 66 light vessels in the service a number are more than 50 years old. To relieve these vessels for necessary repairs and overhauling and to place the older ships on less exposed stations, it is necessary that new vessels be added to the fleet.

No. 20. *Light vessels for general Lake service.*—For constructing and equipping light vessels for general service on the Great Lakes, or for general service, \$150,000.

NOTE.—Light vessels No. 55, No. 56, No. 57, No. 60, No. 61, and No. 62, now stationed on the Great Lakes, are all old, built of wood, and are rapidly deteriorating. Light vessel No. 59 was, during the summer of 1914, condemned as unseaworthy, and was removed from her station at Poe Reel, southern entrance to Straits of Mackinac, Mich. Of the others, light vessels No. 61 and No. 62 are in especially bad condition, and can not be depended upon for service in the stormy fall season. It is proposed to construct two or more vessels, similar in type to those recently built for Lake service, of steel, and fitted with modern light and fog-signal apparatus.

Total group No. 1, \$1,218,000.

GROUP NO. 2.

Works considered essential for the immediate needs of navigation, and for the efficient equipment of the Lighthouse Service:

No. 21. *Depot for second lighthouse district.*—For constructing and equipping a lighthouse depot for the second lighthouse district, \$85,000.

NOTE.—The present depot of the second district for Boston Harbor and vicinity is on Lovells Island, and is there through the courtesy of the War Department only. It is not adapted or situated for a depot where the work can be carried on expeditiously. The tender can not lie there nights on account of being exposed to the weather, and passing steamers make such a swash that the tender's lines are parted. The tide has been known to cover the floor of the storehouse to a depth of 1 foot. The buildings, with the exception of the oil house, are wooden, and in poor condition of repair. The wharf is also in poor condition of repair. The Treasury Department has orders to transfer a piece of the old marine hospital property in Chelsea to the Lighthouse Service at the expiration of the present lease, which takes place December 31, 1916. This property by dredging will have three berths for vessels, ample storage room for buoys, and with a brick fire-proof storehouse would make a first-class depot. Detailed estimate:

Wharf.....	\$10,755
Sea wall.....	11,732
Oil house.....	1,500
Service building.....	34,554
Depot keeper's dwelling.....	6,228
Storehouse.....	2,644
Machine and blacksmith shop.....	2,163
Buoy skid and chain platform.....	1,090
Dredging.....	6,000
Removing present structure from grounds.....	600
Excavating and laying water pipes.....	480
Boundary fence.....	1,395
Contingencies.....	5,859
Total.....	85,000

No. 22. *Detroit, Mich., lighthouse depot.*—For improvements at Detroit, Mich., lighthouse depot, \$53,000.

NOTE.—The following improvements are needed:

Oil house: The arrangements for storage of oil at this depot are very inadequate and unsatisfactory, and oil is stored in one wing of the basement of the main storehouse. The capacity is, however, insufficient, making it necessary to store large quantities of oil in the depot yard, exposed to possible damage or total destruction by fire, owing to the proximity of a varnish works. Furthermore, the handling of oil would be greatly facilitated, as the new structure could be so located as to handle the oil directly from the cars.

Addition to lamp shop: The present lamp shop is greatly overcrowded, owing to the increasing number of lighted buoys and other aids in the district, necessitating a greater and increasing quantity of parts returned for repair. Spare parts can not be accommodated but must be stored in the main storehouse, inconveniently located for the work. It is necessary to do a great deal of blacksmith repair work to moorings of buoys, etc., at the depot during the closed season of navigation, and this work must now be done in the open part of the buoy shed under very severe weather conditions during the winter or at times delayed until the severe storms are over.

Storehouse for cement and lime: Owing to the large amount of construction and repair work necessary in this district, a considerable quantity of cement and lime must be kept on hand. A small building for this storage should be provided.

Reconstruction of wharf: The wharf here has undergone for many years only such repair as necessary to render it serviceable. It is an old wooden structure on cast-iron columns standing on piles cut off about a foot below water level. It should be rebuilt and extended out to the pier line to give additional capacity.

Detailed estimate:

Oil house.....	\$4,000
Addition to lamp shop.....	5,000
Cement and lime storage.....	2,000
Reconstruction of wharf.....	38,000
Contingencies.....	4,000
Total.....	53,000

No. 23. *Staten Island, N. Y., lighthouse depot.*—For improvement of the offices and laboratory at the general lighthouse depot, Tompkinsville, Staten Island, N. Y., \$21,000.

NOTE.—The present office quarters and laboratory at the general depot, Tompkinsville, N. Y., are located in four detached buildings, giving rise to delay and confusion in the orderly handling of work, as well as causing unnecessary expense of heating and other maintenance items. It is proposed to construct an addition which will join three of the present buildings, and make it possible to use the space so gained for the improvement of the laboratory, which is now located in the fourth building. This building is poorly adapted for laboratory purposes, but can be put to good use as a storehouse, which is also needed on account of the growth of the Service. Detailed estimate:

Altering old buildings.....	\$4,500
Foundation.....	1,500
Walls, rough floors, and roof.....	8,000
Interior finish, etc.....	5,000
Contingencies.....	2,000
Total.....	21,000

No. 24. *Huron, Ohio, aids to navigation.*—For establishing aids to navigation at Huron Harbor, Ohio, \$4,500.

NOTE.—The act of June 17, 1910, authorized the establishment of range lights at Huron Harbor, at a cost not to exceed \$3,800, but no appropriation for the object has been made. The erection of a rear range light to serve with the present Huron Light will accomplish the desired object, but provision should also be made for a fog bell at the front light. The commerce of Huron Harbor is important, consisting principally of ore and fish incoming and coal outgoing. Over 300 vessels with a registered tonnage of over 640,000 enter the harbor annually, with a cargo valuation of approximately \$3,000,000. Detailed estimate:

Tower.....	\$1,500
Illuminating apparatus.....	1,800
Fog-signal apparatus.....	1,200
Total.....	4,500

No. 25. *Hawaiian Islands, lighthouse depot.*—For constructing and equipping a temporary lighthouse depot at Honolulu, T. H., pending the establishment of a permanent depot, and authority is hereby granted to erect such temporary depot on land to be leased, \$5,000.

NOTE.—On account of the dilapidated condition of the Territorial building on the channel wharf now occupied as a temporary depot, and the uncertain tenure of this building as a depot, efforts have been made to rent an adequate storehouse, but it was impracticable to secure a single building for this purpose. Should the Territory request the channel wharf vacated, the Lighthouse Service in the Hawaiian Islands would be deprived of all depot facilities. It is therefore recommended that appropriation for the erection of a temporary storehouse be made at the earliest possible date, to provide for the needs of the Service until a permanent depot can be established, for which a separate appropriation has been asked. Detailed estimate:

General storehouse with proper shelving.....	\$5,000
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No. 26. *Hawaiian Islands lighthouse depot.*—For the construction and equipment of a lighthouse depot for the nineteenth lighthouse district, \$90,000.

NOTE.—The greatest need in this district is an adequate lighthouse depot. At present the stores are kept in two small, overcrowded, leaky storerooms on the Channel Wharf, Honolulu, where they are in danger of fire on account of proximity to fishing sampans, which are careless in the handling of gasoline. The heavy stores are kept in a large room adjoining the storage rooms occupied as a depot on Channel Wharf, lately vacated by the Territory because of the condemnation of the wharf. Buoys are kept some on Channel Wharf and some on Naval Wharf No. 1. The heavier buoys can not be kept on the Channel Wharf on account of its dilapidated condition, and when placed on the Naval Dock are exposed to the weather, and are frequently covered with coal when warships are coaling. In assembling materials for any construction work it has been the custom to collect them at the Channel Wharf, and if there is any considerable amount that wharf becomes filled up, necessitating the removal of the material on account of inconvenience to other users. Hence, the lack of a depot results in much inefficiency in collecting materials as well as inconvenience and annoyance. The fact that the temporary wharf and storehouse are in a bad state of repair, having been condemned about a year ago, makes the situation very uncertain and unsatisfactory. Application for the transfer of Naval Wharf No. 3 and of a piece of land (1.2 acres) contiguous to this wharf has been made to the Navy Department. It is proposed to erect adequate buildings and improvements on this site for lighthouse-depot purposes. Detailed estimate:

Repairs and enlargement of wharf.....	\$30,000
General storehouse.....	28,000
Repair plant equipment.....	10,000
Carbide and oil house.....	2,000
Office building.....	10,000
Improvement of grounds, including walks, fences, etc.....	2,000
Contingencies.....	8,000
Total.....	90,000

No. 27. *Point Borinquen, P. R., Light Station.*—For the removal and rebuilding on another site of the light station and dwelling at or near Point Borinquen, P. R., \$85,000.

NOTE.—The present Point Borinquen Lighthouse is improperly located at the foot of a bluff 230 feet high, which obscures the light in the northeasterly direction. To the southward, plantations of high trees obscure the light in its most desirable direction, the harbor of Aguadilla. The present tower is in bad state of

repair, the top part being considered unsafe and the foundation insecure. At the present time the light is inadequate, and with the opening of the Panama Canal it is quite insufficient, as it has now become a most important landfall light. In addition to the light, and in connection with it, it is proposed to install a wireless station which will send automatically the wireless name of the station, which will give vessels an opportunity to locate their position when distant from the shore. Detailed estimate:

Tower, including site.....	\$30,000
Dwelling for three keepers.....	20,000
Illuminating apparatus.....	7,000
Power house and wireless outfit.....	4,500
Outbuildings, piping, etc.....	8,000
Roads and grounds.....	7,000
Contingencies.....	8,500
Total.....	85,000

No. 28. *Light keepers' dwellings*.—For light keepers' dwellings and appurtenant structures, including sites therefor, within the limit of cost fixed by act approved February 26, 1907, \$75,000.

NOTE.—The appropriations made March 4, 1907 (34 Stat., 1319), and May 27, 1908 (35 Stat., 334), of \$75,000 each, are now exhausted, but dwellings at a number of stations are yet needed, among which may be stated: Amelia Island, Fla.; Ano Nuevo Island, Cal.; Buffalo Breakwater, N. Y.; Charlotte, N. Y.; Dry Tortugas, Fla.; Frankfort, Mich.; Oswego Breakwater, N. Y.; Piedras Blancas, Cal.; Point Hueneme, Cal.; Point Montara, Cal.; Point Sur, Cal.; Port San Juan, P. R.; Sand Island, Ala.; Tawas, Mich.; Toledo Harbor, Ohio; Two Harbors, Minn.; Ludington Breakwater, Mich.; Poverty Island, Mich. Detailed estimate:

16 dwellings, at \$4,500.....	\$72,000
Contingencies.....	3,000
Total.....	75,000

No. 29. *Fairport, Ohio, aids to navigation*.—For improving the aids to navigation at Fairport Harbor, Ohio, \$42,000.

NOTE.—The completion of the west breakwater pierhead necessitates a rearrangement of the aids to navigation at this harbor. It is proposed to discontinue the present main light on the bluff and to construct the new light with a fog signal on the pierhead. The west breakwater and pierhead have been completed, and on the east side the breakwater has been built up to the water line throughout its length and the pierhead crib has been placed. The annual number of vessels entering and departing is about 1,300, representing a total registered tonnage of approximately 3,000,000. Detailed estimate:

Structure.....	\$24,000
Illuminating apparatus.....	6,500
Fog-signal apparatus.....	8,000
Boats, piping, etc.....	3,500
Total.....	42,000

No. 30. *Sand Hills, Mich., Light Station*.—For establishing a light station and fog signal at or near Sand Hills, Mich., \$75,000.

NOTE.—A light and fog-signal station at Sand Hills, about 4 miles west of Eagle River, Keweenaw Peninsula, Lake Superior, would be of great service to vessels bound east from the western portion of Lake Superior in warning vessels from the dangerous reefs off the coast. It is reported that 10 vessels stranded on these reefs in recent years, with known losses of over \$1,000,000. Detailed estimate:

Tower.....	\$30,000
Fog signal.....	12,000
Quarters for three keepers.....	15,000
Outbuildings, dock, boat, etc.....	10,000
Contingencies.....	8,000
Total.....	75,000

No. 31. *Manitowoc Breakwater, Wis., Light Station*.—For improving the light and fog-signal station at Manitowoc North Breakwater, Wis., \$21,000.

NOTE.—The present frame building with corrugated iron covering, with very small wooden lantern (not large enough to admit a man) stands on the outer end of the North Breakwater, which is of stone-filled timber construction. The building is old and in poor condition. The timber sills supporting the building are badly rotted. The other timber work is deteriorating. Covering plates are rusting and breaking away at bottom. Cement floor is cracked and the building itself is shaky, due to movement and settlement of pier and to the fact that the building has been moved twice. It is liable to destruction in its exposed position and should be replaced at an early date with a steel building on a concrete base. It is proposed to install an electric-driven air compressor, obtaining current from the city, with oil engine reserve drive, and to provide a brighter light. Detailed estimate:

New fog-signal building, with lantern.....	\$8,500
Fog-signal apparatus.....	6,500
Illuminating apparatus.....	4,100
Contingencies.....	1,900
Total.....	21,000

No. 32. *East River, N. Y., aids to navigation.*—For improving the aids to navigation on the East River, N. Y., \$16,000.

NOTE.—Improvements and changes in system of lights in East River, N. Y., in vicinity of Hell Gate are very much needed, for the present system is inefficient as well as difficult to maintain, especially during the winter with running ice in the river. An appropriation for improving and changing these aids, building new foundations, and establishing acetylene lights in place of present oil lights at Mill Rock Northerly Light, Lawrence Point Ledge Light, Sunken Meadow Light, South Brother Island Ledge Light, Rikers Island Light is recommended. Oak Bluff Light, which is at present of very little service on account of many shore lights now in the vicinity, can be discontinued. Detailed estimate:

Foundations.....	\$9,000
Steel towers and tank houses.....	1,000
Gas tanks and lighting apparatus.....	6,000
Total.....	16,000

No. 33. *Keweenaw Waterway, Mich., aids to navigation.*—For establishing and improving aids to navigation at or near the entrance to Keweenaw Waterway Harbor of Refuge, Portage River, Mich., \$110,000.

NOTE.—The improvements by the War Department are now in progress and will probably be carried through to completion at an early date. Steps should be taken as soon as possible by the Lighthouse Service looking to the proper lighting of the entrance under the new conditions. It is recommended that a light and fog signal be erected on a separate foundation on the outer end of the breakwater, and that six nonattended lights be established to mark the harbor, and, as the work will necessitate changes at the locality, that present range lights Nos. 1 and 2 be rebuilt and provided with gas appliances. The Portage River (Main) Light may be discontinued on the completion of this project, and the dwelling retained as shore station for one keeper. Detailed estimate:

Foundation and concrete base for tower.....	\$43,000
Superstructure.....	24,000
Illuminating and fog-signal apparatus.....	9,000
Establishing six minor lights.....	24,000
Rebuilding lights Nos. 1 and 2.....	6,000
Contingencies.....	4,000
Total.....	110,000

No. 34. *Cape Charles City, Va., aids to navigation.*—For improving lights and fog signals leading to Cape Charles City, Va., \$12,800.

NOTE.—Harbor improvements at this point in recent years have rendered Cherrystone Light and Fog Signal of little use in the present location. A new light and fog bell should be established close to turn in dredged channel and range lights should be established for dredged channel. It is proposed to establish acetylene gas lights and electrically operated fog-bell strikers. The illuminating apparatus on existing aids in this harbor should be improved by the installation of acetylene gas instead of present oil lights. Detailed estimate:

New concrete structure for light and fog bell.....	\$2,500
Illuminating apparatus.....	1,500
Fog-bell striker and electric cable.....	2,820
Structural steel tower and foundation.....	1,000
Apparatus for three acetylene range lights.....	3,180
Apparatus for two minor lights in vicinity.....	800
Contingencies.....	1,000
Total.....	12,800

No. 35. *Chesapeake Bay, Md. and Va., aids to navigation.*—For establishing and improving aids to navigation on the eastern shore of Chesapeake Bay and tributaries, Maryland and Virginia, \$29,000.

NOTE.—The eastern shore of Chesapeake Bay presents an intricate system of waterways which are inadequately lighted. The deep channels are narrow and crooked, and the wide flats are covered by only a few feet of water. The interests of a large part of the population of this country are maritime, large numbers of passengers are carried on regular lines of steamers to many ports, great quantities of truck and other produce move by water to Baltimore, and the fish, crab, and oyster industries are very important. The following items are considered necessary to provide an adequate system of lighted aids for these waters. Detailed estimate:

20 structures for minor lights.....	\$6,000
15 acetylene equipments.....	6,000
5 oil equipments.....	300
5 structures, unlighted beacons.....	1,500
12 gas buoys and moorings.....	14,400
Contingencies.....	800
Total.....	29,000

No. 36. *Alaska, aids to navigation.*—For the establishment of aids to navigation and the improvement of existing aids in Alaska, \$60,000.

NOTE.—The appropriation of \$60,000 made by the act of August 1, 1914, will be practically exhausted when the construction of aids already authorized has been completed. Maritime interests are urging the establishment of additional aids to assist the mariner in Alaskan waters, where navigation is unusually difficult and dangerous and where wrecks and costly accidents to vessels are of frequent occurrence. The commerce of the district is increasing in volume, owing in part to the opening of the Panama Canal and

the inauguration of construction work on the Government railroad, and new routes of navigation are being opened up. Additional fog signals are needed on the principal channels of southeastern Alaska, and additional unwatched lights should be installed as soon as possible on the main route from Ketchikan to Skagway, in Icy Straits, in Peril Strait, and Sitka Sound, on the west coast of Prince of Wales Island, in Prince William Sound, and on the coast between Resurrection Bay and Cook Inlet. Detailed estimate:

17 lights.....	\$26,400
3 gas buoys.....	9,600
2 fog-signal installations.....	24,000
Total.....	60,000

Total group No. 2, \$784,000.

Total groups Nos. 1 and 2, \$2,002,300.

GROUP NO. 3.

Works considered essential for the needs of navigation and the equipment of the Lighthouse Service, and which it is recommended be undertaken as resources permit, are submitted with estimates of cost. (These items have been selected from a much larger number of recommendations submitted by the inspectors of the lighthouse districts and others.)

No. 37. *Ludington, Mich., aids to navigation.*—For improving the aids to navigation and establishing new aids at Ludington, Mich., \$35,000.

NOTE.—The present location of the fog-signal station on the end of south pier subjects vessels to danger of striking the breakwater. The commerce of Ludington, which includes important car ferry lines across Lake Michigan, is more important than any other port on the east shore of Lake Michigan, and as this port is most inadequately lighted now this improvement is considered well warranted. It is proposed to establish a main light on the outer end of the north breakwater, with fog-signal apparatus, consisting of electrically driven air compressor and siren with oil engine reserve drive, and to discontinue the present steam fog signal in old wooden structure. Quarters for keepers should be erected adjacent to the light, as it is unsafe to cross the harbor during the winter when the ice is broken up by car ferries. Detailed estimate:

Foundation and tower.....	\$4,590
Fog-signal building.....	2,600
Illuminating apparatus.....	2,350
Fog-signal apparatus.....	6,500
Quarters for three keepers, including site.....	15,950
Minor lights on north and south pierheads.....	2,600
Contingencies.....	410
Total.....	35,000

No. 38. *Tampa Bay, Fla., aids to navigation.*—For establishing and improving aids to navigation in Tampa Bay, Fla., \$12,000.

NOTE.—Tampa is an important seaport with a large and growing commerce by sea. Owing to shallow water in Tampa Bay, deep-draft vessels can reach the city from the Gulf only by means of several comparatively narrow dredged cuts. Provision has already been made for lighting all of the important cuts excepting Cut D, for which lights should be provided as soon as practicable, as large vessels must pass through this cut in order to reach Port Tampa. Detailed estimate:

Concrete foundation.....	\$2,000
Metal work towers.....	5,000
Illuminating apparatus.....	4,000
Contingencies.....	1,000
Total.....	12,000

No. 39. *Delaware Bay entrance, aids to navigation.*—For improving the aids to navigation at the entrance to Delaware Bay, \$75,000.

NOTE.—In consequence of the continued erosion of the shore line in the vicinity of Cape Henlopen Light, Del., the early destruction of that light is anticipated, measures taken for the preservation of the shore line having proved unavailing. Every purpose now served by Cape Henlopen Light would be better served by the rebuilding of Harbor of Refuge Light to a height of about 140 feet. The establishment of large gas buoys is also required, one midway between, and in the line connecting Five Fathom Bank Light Vessel and Overfalls Light Vessel, one at the extreme lower and outer end of Hen and Chickens Shoal, and one in approximately the present position of Fifteen Foot Shoal Buoy. With the improvements recommended herein, including a red sector in the new Harbor of Refuge Light to cover Brown Shoal, the ultimate fate of Cape Henlopen Light will have no bearing on the practical needs of navigation in this vicinity. Detailed estimate:

Rebuilding Harbor of Refuge Light Station.....	\$56,676
3 gas and bell buoys on station.....	10,770
1 relief gas and bell buoy.....	3,590
2 extra gas tanks.....	1,160
2 extra 375 mm. lanterns.....	1,770
Sinkers and moorings for buoys.....	1,034
Total.....	75,000

No. 40. *Goose Island Flats, N. J., Light Station.*—For establishing a light and fog signal at or near Goose Island Flats, N. J., \$120,000.

NOTE.—Vessels navigating the Delaware River are obliged to make a decided turn at this point. A temporary structure, protected by riprap, was carried away by the ice in January, 1910, although the

riprap is partially in place and forms a menace to navigation unless properly marked. A buoy is now maintained at this location, but in winter it is impossible to keep it in position on account of the heavy ice. It is proposed to erect a light and fog signal, on a suitable heavy caisson foundation, close to the channel on the easterly side. Detailed estimate:

Foundation in place.....	\$65,000
Metal work for superstructure.....	18,000
Erection of superstructure.....	20,000
Illuminating apparatus.....	3,000
Fog signal apparatus.....	5,000
Contingencies.....	9,000
Total.....	120,000

No. 41. *Alaska, lighthouse depot.*—For the purchase of a site for a lighthouse depot and the necessary equipment so far as funds may permit for the sixteenth lighthouse district, \$50,000.

NOTE.—There is no lighthouse depot in Alaska, and the work of the lighthouse service is considerably handicapped by the lack of such facilities. Temporary quarters are now rented at \$325 per month, which would be unnecessary if proper facilities were owned by the Government. It is not intended at this time to erect office quarters, etc., for which further arrangements in other Federal buildings may be made in the future. Detailed estimate:

Purchase of site.....	\$40,000
Repairs, equipment, dock, etc.....	10,000
Total.....	50,000

No. 42. *Indian River, Fla., aids to navigation.*—For improving the aids to navigation and establishing new aids on the Indian River, Fla., \$8,500.

NOTE.—There has been a demand for lights on this river for some time past, and the traffic thereon has increased considerably. The river is navigable for light-draft vessels for a distance of over 100 miles, and it has been improved by dredging in many places under authority of Congress. It is proposed to establish about 30 lights, which it is believed will be sufficient for the purpose. Detailed estimate:

30 pile dolphins.....	\$3,750
20 oil lights.....	350
10 acetylene lights (for the more isolated localities).....	3,500
Contingencies.....	900
Total.....	8,500

No. 43. *South Pass, La., light vessel.*—For constructing and equipping a light vessel for South Pass entrance to Mississippi River, La., or for general service, \$125,000.

NOTE.—The act of October 22, 1913 (38 Stat., 224) appropriated \$125,000 for a light vessel for Southwest Pass, but did not provide for South Pass, where there is urgent need for a similar vessel, as both passes are open and used. In the year 1913 over 3,600 vessels, with a tonnage of over 8,000,000, entered the port of New Orleans, and the total value of imports and exports during that period was over \$314,000,000. It is proposed to construct a steel self-propelling vessel equipped with modern light and fog-signal apparatus, similar to that authorized for Southwest Pass.

No. 44. *Sand Island Light Station, Ala.*—For improving Sand Island Light Station, Ala., \$45,000.

NOTE.—In October, 1906, a storm destroyed the dwelling at this station, and since that time the keepers have used the tower as a dwelling. These quarters are not suitable, and it is recommended that a dwelling be erected. There is great need for a fog signal at this station, which at present has none. Fog prevails for a large portion of the winter and spring season, making the entrance to Mobile Bay difficult and dangerous at times. It is recommended that the station be equipped with modern fog-signal apparatus. The brick tower, which was originally erected on Sand Island, now stands surrounded by an artificial island of rock, the sand island having washed away. The quantity of rock protection around the tower should be increased, about 3,000 tons of rock being required. Detailed estimate:

Riprap.....	\$26,000
Dwelling for three keepers.....	8,000
Fog signal building.....	3,000
Fog-signal apparatus.....	7,000
Contingencies.....	1,000
Total.....	45,000

No. 45. *Point Pinos, Cal., Light Station.*—For improving Point Pinos Light Station, Cal., \$29,000.

NOTE.—Improvements to the combined tower and dwelling at this station are required to keep them in a serviceable condition. Fogs are of frequent occurrence at this point, and a first-class compressed-air signal, together with quarters for two additional keepers, are urgently required. Traffic into Monterey Harbor is steadily increasing and a number of large oil-carrying steamers now run regularly to this port, where oil is piped from the oil fields in the interior of the State. Detailed estimate:

Fog-signal building.....	\$3,000
Fog-signal apparatus.....	7,000
Dwellings for two keepers.....	12,000
Improvements to present station.....	4,500
Contingencies.....	2,500
Total.....	29,000

No. 46. *Spectacle Reef Light Station, Mich.*—For improving Spectacle Reef Light Station, Mich., \$20,000.

NOTE.—The wall surrounding the tower and supporting the fog-signal building and boathouse is disintegrating at the water line and should be repaired before further damage occurs. It is proposed to place a belt of steel flashing around the entire pier, commencing about 4 feet below the water line and extending about 3 feet above, fastening the same by heavy expansion bolts and back filling the voids with concrete after placing the plate. Detailed estimate:

Steelwork in place.....	\$7,500
Concrete backing.....	6,000
Anchor bolts.....	3,500
Contingencies.....	3,000
Total.....	20,000

No. 47. *Michigan Island Light Station, Wis.*—For establishing a light and fog-signal station on Michigan Island (Lake Superior), Wis., \$100,000.

NOTE.—The act approved May 27, 1908 (35 Stat., 332), appropriated \$2,000 to make a survey and estimate the cost and report upon the feasibility and need of establishing a light and fog signal upon Gull Island or the easterly end of Michigan Island, Apostle Group. As a result of this survey, the conclusion has been reached that the eastern end of Michigan Island is the better site. The act of June 17, 1910 (36 Stat., 536), authorized the construction of a light and fog-signal station at Michigan and Gull Islands at a cost not to exceed \$140,000, but no appropriation has been made therefor. Detailed estimate:

Tower and fog-signal building.....	\$45,000
Illuminating apparatus.....	7,000
Fog signal.....	9,000
Dwellings for three keepers.....	18,000
Outbuildings, boats, etc.....	6,000
Fences, walks, derricks, etc.....	5,000
Contingencies.....	10,000
Total.....	100,000

No. 48. *Kauhola Point, Hawaii, Light Station.*—For improving the light station at Kauhola Point, Hawaii, \$19,000.

NOTE.—Owing to the importance of this station, located near the northern point of the Island of Hawaii steps have been taken to change the present lens-lantern light to a converted flashing fourth-order lens. To support this lantern and lens and to complete the improvement of this station, a new tower is necessary. A dwelling for the assistant keeper should also be provided. Detailed estimate:

75-foot cast-iron tower.....	\$10,000
Erection at site complete.....	3,600
Dwelling.....	4,000
Contingencies.....	1,400
Total.....	19,000

No. 49. *Goat Island, Cal., lighthouse depot.*—For repairs and improvements to Goat Island lighthouse depot, near San Francisco, Cal., \$51,000.

NOTE.—This depot occupies a small area gained by cutting down the steep bluff at the southeast point of Goat Island in San Francisco Bay and filling in along the shore line with the material thus secured. This area and that afforded by the present wharf is now inadequate to afford a proper disposition of the property required to be stored there. This is the only depot in the district. An additional area should be filled in with excavated material to afford room for new storehouses and additional room for storing buoys. The present storehouses are merely wooden sheds, old and poorly constructed. The present wharf should be extended to afford room for working two tenders alongside at the same time, and to permit landing and loading supplies without having to shift material already stored on the wharf. The quarters provided for the depot force are old and insanitary in arrangement and location. New quarters for the keeper and assistant keeper of the depot should be provided on higher ground and the site of the present quarters utilized for the needs of the depot proper. Detailed estimate:

Retaining wall and fill.....	\$5,000
Storehouse, reinforced concrete.....	18,000
Wharf, additional, on iron piles.....	12,000
Dwellings.....	16,000
Total.....	51,000

No. 50. *Santa Barbara, Cal., Light Station.*—For improving Santa Barbara Light Station, Cal., \$29,000.

NOTE.—The station is old and the tower is too small to accommodate the revolving lens now installed in it. The tower stands one-eighth of a mile back from the point of the shore line and the light is partly obscured by trees on other properties. A new tower is required to be built farther out on the point. Coasting vessels bound north keep close inshore to avoid the prevailing northwesterly wind and sea, and a fog signal should be established here with quarters for two additional keepers. An improvement has been made in changing the light from fixed to occulting and an increase of intensity. The fog signal, as well as other improvements, and a new light tower, are necessary to render the aids efficient. Detailed estimate:

Tower, lantern, and fog-signal building.....	\$8,000
Fog-signal apparatus.....	7,000
Additional quarters.....	7,000
Improvements to present station.....	4,500
Contingencies.....	2,500
Total.....	29,000

No. 51. Cape Spencer, Alaska, Light Station.—For establishing a light and fog-signal station at or near Cape Spencer, Alaska, \$100,000.

NOTE.—Cape Spencer is at the entrance to Cross Sound and Icy Strait, through which pass all vessels running from Puget Sound ports to Prince William Sound, Seward, Cook Inlet, and Kodiak, excepting only occasional freighters proceeding by the outside route. With the construction of the proposed Alaskan railroad the traffic by way of Cape Spencer will be materially increased. A small unwatched light is now maintained on the cape, but it is believed that a large watched light and fog signal should be provided, especially for vessels returning from the westward, to be used as a landfall, as it is important that they be given all possible assistance, especially in thick weather. Maritime interests have urged the establishment of this aid. Detailed estimate:

Foundation.....	\$4,000
Buildings and tower.....	72,000
Illuminating apparatus.....	9,000
Fog-signal apparatus.....	6,000
Contingencies.....	9,000
Total.....	100,000

No. 52. Potomac River, Md., aids to navigation.—For improving the aids to navigation and establishing new aids on the Potomac River, Md., \$120,000.

NOTE.—The Potomac River, from Maryland Point to Washington, about 40 nautical miles, is now lighted only by 4 gas buoys, 5 minor lights, and 1 lighthouse. The gas buoys are of low candlepower and are of necessity removed from station for several months in winter on account of ice conditions. The minor lights are all fixed white or red lights of low candlepower, located on wharves or on timber structures, which are liable to destruction by ice in winter. Jones Point Light Station is of little use on account of changes in shore line at this point. It is proposed to establish 8 sets of flashing acetylene range lights and 7 or more flashing acetylene single lights, and to replace 15 of the present spar buoys by tall nun buoys more readily picked up at night. Jones Point Light Station and the 5 minor lights above mentioned may then be discontinued. Detailed estimate:

Purchase of sites for 10 lights.....	\$24,800
Towers for 10 lights on land, including foundation.....	14,300
Concrete structures for 6 lights on marine sites.....	28,200
Structures for 7 lights on land.....	4,900
Illuminating apparatus for 23 lights.....	32,700
Fifteen tall-type buoys and moorings.....	5,100
Contingencies.....	10,000
Total.....	120,000

No. 53. Depot for fifth lighthouse district.—For enlarging and improving the light-house depot at Portsmouth, Va., in the fifth lighthouse district, or for establishing a new depot, \$275,000.

NOTE.—The present lighthouse depot at Portsmouth, Va., is entirely inadequate to the needs of the fifth district, both in area and in water front. This is the principal depot of the largest lighthouse district and is the headquarters for five tenders and two light vessels during the greater part of the year. The aggregate length of these vessels is over 1,000 feet; the total wharf frontage is only 445 feet, of which over 200 feet is in a narrow slip available for small light-draft vessels only. The operation of tenders is much hampered by this limited frontage. The very small area available for buoy storage necessitates much otherwise unnecessary handling of heavy buoys and appendages at large cost of time and money. The available wharf frontage of this depot should be doubled, and the area increased by from 4 to 6 acres. This may be done by purchase of a new and larger site, or by purchase of adjacent property. The present buildings are mainly antiquated wooden structures. They constitute a fire menace and should be replaced by modern fireproof buildings. Detailed estimate:

Purchase of water-front property.....	\$125,000
Construction of wharf.....	52,125
Filling, grading, and paving.....	42,000
Storehouse, coal shed, repair shop, and keepers' dwelling.....	37,375
Water mains, fire-protection system, and traveling electric crane.....	8,500
Contingencies.....	10,000
Total.....	275,000

No. 54. Tender for third lighthouse district.—For constructing, or purchasing and equipping a lighthouse tender to replace tenders worn out in service in the third lighthouse district, or in the Lighthouse Service generally, \$150,000.

NOTE.—There are three tenders in the third district that are old and of obsolete types, and should be replaced as soon as practicable by modern efficient vessels. These are the *Gardenia*, *John Rodgers*, and *Mistletoe*. All of these tenders to be kept in commission require repairs that are not warranted by their age and the service obtained from them. At least one new tender for this district is an urgent present need, and should be followed by other tenders as rapidly as funds become available.

No. 55. Gas buoys, fifth lighthouse district.—For the purchase of additional gas buoys for the improvement of aids to navigation in the fifth lighthouse district, \$35,000.

NOTE.—A number of deserving projects for the establishment of additional gas buoys should be provided for. Some of these have already received the approval of the Commissioner of Lighthouses, but funds have not been available for their establishment. Detailed estimate:

Thimble Shoal Dredged Channel, Va., 5 buoys.....	\$17,500
Holland Island Bar, Md.....	2,500
Approach to Beaufort, N. C.....	3,500
Tail of Horseshoe, Va.....	3,500
Blue Channel, Thimble Shoal, Va.....	2,500
Relief buoys.....	5,000
Contingencies.....	500
Total.....	35,000

No. 56. *Chicago Harbor Light Station, Ill.*—For removing and rebuilding Chicago Harbor Light Station, Ill., and establishing lights on the new breakwater in Chicago Harbor, \$142,000.

NOTE.—The present Chicago Harbor Light Station is built on an isolated pier at the southeast end of the existing outer breakwater. The United States engineers are planning the construction of two new breakwaters with a gap between, running south from the existing breakwater, and expect to have the first section of this project completed by December, 1916. This will necessitate the moving of the present Chicago Harbor Light from its present position to the proposed entrance of the outer harbor of Chicago, Ill. It is recommended that a new pier be built just inside the outer end of the breakwater 65 feet by 65 feet and the present cast-iron tower structure, lantern, lens, fog signal boilers, and machinery be taken down and rebuilt in new position; also a new steel fog-signal building, boathouse, and storeroom and power derrick be erected. The light in the new location ought to be put into commission as soon as practicable after the completion of the extension to the breakwater. There will also be needed two acetylene beacons, one at the north end and the other at the south end of the extension of breakwater south of the entrance gap through the breakwater. Detailed estimate:

Steel caisson.....	\$15,519
Water tight plank deck floor to float caisson.....	3,042
Piling.....	6,379
Pumping out silt bottom.....	1,700
Concrete fill.....	60,000
Concrete pier.....	13,200
Taking down and rebuilding tower, lantern, lens.....	5,000
Fog signal building.....	10,000
Storehouse and boathouse.....	5,000
Derrick.....	1,000
Fog signal apparatus.....	1,200
Outer Breakwater South Light.....	3,530
Outer Breakwater North Light.....	3,530
Contingencies.....	12,900
Total.....	142,000

No. 57. *Cape Fear Light Station, N. C.*—For the removal of the Cape Fear Light Station, N. C., and appurtenant structures, and rebuilding of the station on the Bald Head Lighthouse Reservation, or other new site, \$35,000.

NOTE.—Erosion at Cape Fear Light Station, due to the action of the sea, has been in progress for a number of years, and at the present rate will render the lighthouse and dwellings unsafe in a comparatively short time. On account of the long stretch of shore line it is believed that attempted shore protection would be unduly expensive and probably unsuccessful. It is considered the wisest measure to remove the lighthouse and the keeper's dwellings to Bald Head Lighthouse Reservation or some other site where the light will serve its purpose as a primary seacoast light practically as well as at the present site. Detailed estimate:

Construction of tramway.....	\$7,225
Taking down tower.....	2,400
Moving and reerection of tower.....	6,200
Removing and rebuilding three dwellings.....	12,000
Superintendence.....	4,000
Contingencies.....	3,175
Total.....	35,000

No. 58. *Hilo, Hawaii, aids to navigation.*—For establishing and improving aids to navigation at Hilo, Hawaii, \$13,000.

NOTE.—Hilo is the second port of importance in the Hawaiian Islands, and it is probable that the opening of the Panama Canal will greatly increase its shipping. The present lighting is inadequate. It is proposed to establish, (1) an acetylene light in place of the present lens lantern at Alia Point, the entrance to Hilo Bay; (2) an acetylene light on the end of the Hilo Breakwater when completed. Detailed estimate.

Alia Point light.....	\$10,000
Hilo Breakwater light.....	3,000
Total.....	13,000

No. 59. *Portage Lake, Mich., aids to navigation.*—For establishing a light and fog-signal station upon a new site and improving aids to navigation at Portage Lake Ship Canals, Mich., \$100,000.

NOTE.—The War Department intends to remove the breakwater, and it is therefore necessary to rebuild the light and fog signal on a new site. The new light and fog signal should be established on a pier at the outer entrance, where it would be of the best service to vessels making the harbor. The construction of the station proposed will require considerable time to complete, and this project should have consideration for that reason. Detailed estimate:

Dredging, piling, and cribwork.....	\$15,000
Stone filling and riprap work.....	10,000
Concrete base with metal flashing.....	30,000
Superstructure.....	30,000
Fog signal and lighting equipment.....	9,000
Contingencies.....	6,000
Total.....	100,000

No. 60. *Ram Island, Me., light.*—For establishing a light on Ram Island, Lower Kennebec River, Me.; \$3,100.

NOTE.—The need of this light has several times been expressed by petition. Ram Island is about 5½ miles below Bath, Me.; it is a low island in the middle of the river, with a string of half-tide ledges making off on the easterly side. There is a passage on either side, and at some stages of the tide a 5-knot current exists, from which several accidents have occurred. About 300,000 tons of freight and 175,000 passengers are transported past this island annually, not including the many pleasure craft and small boats which frequent the river. It is proposed to establish an acetylene light on or near the easterly side of Ram Island. Detailed estimate:

Light structure, including site.....	\$1,600
Illuminating apparatus.....	1,300
Contingencies.....	200
Total.....	3,100

No. 61. *Cape Kumukahi, Hawaii, Light Station.*—For establishing a light at or near Cape Kumukahi, Hawaii, \$22,000.

NOTE.—Cape Kumukahi is the easternmost cape of Hawaii. There is at present no landfall light for vessels bound to Hilo from the Panama Canal or from the southeast. It is a difficult point to round when sailing from Hilo to the south point or vice versa. A light on this point would be a great improvement to the lighting of the islands. The country in this vicinity is barren, undulating lava rock. An acetylene light is recommended with a focal plane height of about 150 feet, which would be visible about 20 miles. Landing from seaward at the cape is impossible at most times, and the only practical method of supplying this station would be by railroad from Hilo to Kapoho and then by wagon road 3 miles to the cape, 1½ miles of which would have to be constructed over the rock. Detailed estimate:

Road.....	\$6,500
Tower, including site and right of way.....	9,300
Illuminating apparatus.....	4,000
Contingencies.....	2,200
Total.....	22,000

No. 62. *Washington and Oregon, aids to navigation.*—For the establishment of aids to navigation and improvement of existing aids in Washington and Oregon, seventeenth lighthouse district, \$35,000.

NOTE.—There has been an increasing demand from shipping interests for additional lighted aids in these waters. It is also desirable to improve a number of existing aids which are now obsolete and unsatisfactory. Gas buoys are desired at Coos Bay, Oreg., Grays Harbor, Willapa Bay, Georgia Strait, and Puget Sound, Wash., and improved lights at a number of places in the lower Columbia River, Wash. and Oreg., and on Clark and Cypress Islands, Wash. Detailed estimate:

7 gas-lighted buoys, at \$3,000.....	\$21,000
14 unwatched gas lights, at \$1,000.....	14,000
Total.....	35,000

No. 63. *Henderson Point, Me., Light Station.*—For establishing a light and fog signal at or near Henderson Point, Piscataqua River, Portsmouth Harbor, Me., \$3,800.

NOTE.—The need of this aid has several times been expressed by petition. It is often very difficult to locate Henderson Point at night and in thick weather; the channel is narrow and there is a strong tide at this point, where the course changes. The commercial statistics for Portsmouth Harbor indicate about 5,600 vessels arriving and departing annually, transporting about 610,000 tons of freight. It is proposed to establish an acetylene light with fog bell. Detailed estimate:

Structures, including sites.....	\$1,800
Illuminating and fog-signal apparatus.....	2,000
Total.....	3,800

No. 64. *Port Real, P. R., Light Station.*—For establishing a light station at or near Port Real, P. R., \$34,000.

NOTE.—The lighthouse at Port Ferro, on the south coast of Vieques or Crab Island, is one of the primary seacoast lights of the Porto Rican system. The light tower and the keepers' dwelling attached to it are built on top of a rocky promontory undermined for some time by the sea, and the whole structure, already dangerously cracked, is in danger of collapsing. It is urgent to rebuild a lighthouse at or near this point, as this is an important aid to the navigation from St. Thomas to Cuba and other West Indian Islands and the Caribbean Sea. A light in this vicinity is necessary for navigation, and it is proposed to dismantle the present Port Ferro Light Station and to erect a new light station at Port Real, about 3 miles westward, where the aid will be more useful and on better ground than on its present location at Port Ferro, as Port Real is the most important and the best anchorage around Vieques Island. The present apparatus at Port Ferro is to be used for this new station. Detailed estimate:

Tower and dwellings for two keepers.....	\$25,000
Outbuilding and piping.....	1,000
Purchase of site.....	2,000
Roads and grounds.....	2,000
Contingencies.....	4,000
Total.....	34,000

No. 65. *Nine Mile Point, Mich., Light Station.*—For establishing a light and fog-signal station at or near Nine Mile Point, Mich., \$50,000.

NOTE.—When Forty Mile Point Light Station was established it was placed on the site designated Forty Mile Point on the county-survey charts. Sailing masters expected the station to be placed at Nine Mile Point, near the entrance to the Straits of Mackinac, but which was not so called officially then. While Nine Mile Point is within the visibility of Spectacle Reef and Poe Reef Light Vessel lights, a fog signal would be of especially great service in thick and foggy weather and during seasons when forest fires prevail. Not less than nine strandings occurred here between 1903 and 1909. In the event of establishing this station, Forty Mile Point could be made a minor light. Detailed estimate:

Tower.....	\$15,000
Illuminating apparatus.....	2,000
Fog-signal building and apparatus.....	9,000
Dwellings for three keepers.....	15,000
Outbuildings, boathouse, fences, etc.....	6,000
Contingencies.....	3,000
Total.....	50,000

No. 66. *Anacapa Island, Cal., Light Station.*—For establishing a light and fog signal at or near Anacapa Island, Cal., \$103,000.

NOTE.—Practically all coastwise vessels and a large number of those bound for Panama use the Santa Barbara Channel, and this traffic will be greatly increased with the opening of the Panama Canal. The desirable course leads close to the eastern end of Anacapa Island, which is now marked by a small beacon light, not sufficiently powerful to be of service in hazy weather. The American Shipmasters' Association has presented a petition for a light and fog signal, indorsed by the San Francisco and Los Angeles chambers of commerce and important shipping interests on the Pacific coast. It is therefore recommended that a light of high candlepower and a first-class fog signal be established at this point as soon as practicable. Detailed estimate:

Light tower.....	\$9,000
Illuminating apparatus.....	8,500
Fog-signal building and apparatus.....	14,000
Two sets double quarters for four keepers.....	24,000
Oil house, outbuildings, etc.....	6,000
Wharf, launch landing, and derrick.....	11,000
Roads, grading, and fencing.....	7,000
Water supply and sewerage system.....	14,000
Contingencies.....	9,500
Total.....	103,000

No. 67. *Caribbean Sea, aids to navigation.*—For establishing aids to navigation in the Caribbean Sea along routes leading to the Panama Canal, \$60,000.

NOTE.—The need for aids to navigation in the Caribbean Sea has become more urgent with the increase of traffic due to the Panama Canal, and such aids have been requested by the steamship companies using these routes. It is proposed to establish gas and whistling buoys at Farrall Rock (Gorda Bank), Southwest Cay (Serrana Bank), Formigas Bank, and Blower Rock (Pedro Bank), an unwatched acetylene light on the south end of Old Providence Island, and a first-class can buoy to mark the north end shoal of Old Providence Island. Detailed estimate:

Four gas and whistling buoys with moorings, etc., on station.....	\$26,000
Two gas and whistling buoys with moorings, etc., relief.....	13,000
One first-class can tall type buoy.....	1,000
Tower in place.....	12,500
Illuminating apparatus.....	4,500
Contingencies.....	3,000
Total.....	60,000

Total, group No. 3, \$1,999,400 (not included in total of estimates).

DESCRIPTIONS OF NEW WORKS COMPLETED.

The following are brief technical descriptions of important lighthouse works completed since the end of the fiscal year 1914:

OIL HOUSES FOR LIGHT STATIONS.

Purpose.—Isolated fireproof structures for the storage of kerosene and other inflammable supplies were erected at 7 light stations, in order to lessen the hazard of fire at such stations. These oil houses were constructed under allotments made from the balances existing under appropriations of \$10,000 each by the acts of May 27, 1908, March 4, 1909, and June 25, 1910. Details regarding each are shown in the following table:

District.	Station.	Site and structure.	Completed.	Cost.
3d.....	New Haven, Conn.....	Two tanks installed.....	Aug., 1914	\$307
	Southwest Ledge, Conn.....	do.....	Sept., 1914	438
	Saugerties, N. Y.....	Brick house 8 by 10 by 7 feet.....	do.....	230
	Whale Rock, R. I.....	One tank installed.....	do.....	164
	Stratford Shoal, N. Y.....	do.....	Feb., 1915	258
9th.....	Point Jiguero, P. R.....	Reinforced concrete throughout.....	Sept., 1914	292
19th.....	Honolulu Harbor, Hawaii.....	do.....	June, 1915	550

BRANDYWINE SHOAL LIGHT STATION, DEL.

Purpose.—This light station was established in 1851 and the structure had deteriorated to such an extent that it became necessary to rebuild it. The lighthouse was established to mark a dangerous shoal of the same name on the Delaware side of the main ship channel in Delaware Bay. The new station went into commission October 20, 1914.

Site.—The station is located on Brandywine Shoal, easterly side of the main channel. It is placed on a submarine site; the depth of water is 8 feet at mean low water, and the rise and fall of the tide is 6 feet. A boring was made at the site 70 feet below bottom of bay and showed hard compact sand.

Structure.—The foundation of the structure consists of a reinforced concrete pier filled with sand, stone, and concrete, 35 feet in diameter. At the top of this pier is a reinforced concrete deck 46 feet in diameter and 24½ feet above mean low water. The deck supports a three-story dwelling of reinforced concrete, circular in plan, from the roof of which projects a circular watch room, which supports a third-order cylindrical helical-bar lantern whose focal plane is 60 feet above high water. The main deck is covered by a veranda roof and there are galleries with railings on a level with the watch-room floor and lantern floor. The concrete pier was constructed on shore, launched, towed out to the site, and sunk in place on a pile foundation. The pile foundation consists of 74 timber piles driven about 3 feet on center to a penetration of 19 feet. The heads of the piles project 1 foot above the surface of the shoal, upon which the concrete pier rests. In addition to the wooden pile foundation, the lighthouse is also fixed in position and supported by 12 reinforced concrete piles 16 inches in diameter and 34 feet long. These piles were driven into the shoal through annular pockets near the outer circumference of the caisson and the pockets around the piles filled with concrete. A layer of riprap protects the bottom about the structure.

Illuminating apparatus.—The illuminating apparatus consists of a standard third-order lens showing an occulting light having an eclipse of 3 seconds duration every 30 seconds. The occultations are produced by a brass shade falling around the light. This shade is operated by a standard fourth-order clock. The intensity of the light is 12,000 candles, the focal plane is 60 feet above mean high water, and the light is visible 13 miles in clear weather. The light is furnished by a 55 millimeter single-tank incandescent oil-vapor lamp.

Fog signal.—This consists of a third-class Daboll reed box with 3 trumpets pointing in different directions. The compressing outfit consists of a 5-horsepower kerosene oil engine, belt connected to an air compressor arranged to start in 10 minutes.

Quarters.—There are quarters for three keepers. They consist of a basement containing a large room for the fog signal and several small ones for coal and oil, below which are the cisterns and water tanks. The first floor contains entrance hall, kitchen, and closets; the second floor provides bedrooms and closets; and the third floor bedrooms and closets. Above this is a watch room. Supplies are landed at the station by the tender. There are two landing platforms and ladders and davits for hoisting the keepers' boats.

Cost.—The station was constructed under the act of March 4, 1911, appropriating \$75,000. It was constructed under several contracts and completed on November 1, 1914. The total cost was \$74,960.34.

AIDS TO NAVIGATION, ALASKA.

Purpose.—During the past year 1 acetylene light, 1 oil light, and 4 beacons were established, structures for 11 lights were erected, ready for the illuminating apparatus, and material is on hand or in transit for 19 others, all of which, it is expected, will be in commission by the fall of 1915. These aids are being established to meet the demands of an increasing commerce and to continue the work of properly lighting and marking these waters. The following is a description of the aids completed and put into commission during the past year:

No.	Name of aid.	Site of locality.	Structure.	Illuminating apparatus.
1	Beacon Point Beacon.	Frederick Sound..	White, slatted tripod; square target.	None.
2	Craig Dolphin.....	San Alberto Bay..	Unpainted pile.....	None.
3	Fish Creek Beacon	Tongass Narrows..	5-pile dolphin; red triangular target.	None.
4	Ratz Harbor Beacon.	Clarence Strait....	White, pyramidal slatted structure; red triangular target.	None.
5	Rugged Island....	Resurrection Bay..	White wooden house supporting a lens lantern 10 feet above ground.	200-millimeter acetylene light, 2 white flashes of 0.3 sec. every 6 sec., of 130 candlepower obscured from 328° to 146°. Focal plane 102 feet above high water; visible 9 miles.
6	South Flat, north end.	Wrangell Strait...	Unpainted pile dolphin; black, square, slatted day-mark.	Post lantern oil light fixed white, of 40 candlepower 12 feet above high water.

Dates of establishment and costs of the above aids are as follows: No. 1, September 23, 1914, \$48; No. 2, September 25, 1914, \$48; No. 3, January 25, 1914, \$140; No. 4, August 28, 1914, \$58; No. 5, August 9, 1914, \$1,195; No. 6, December 1, 1914, \$252.

Fog signals.—There are none.

Quarters.—There are no quarters as these lights are of the unwatched type.

Costs.—The total expenditures from the last appropriation of August 1, 1914, amount to \$43,073.98, leaving a balance of \$16,926.02, of which about \$7,000 is obligated.

KEEPER'S DWELLING, BARBERS POINT LIGHT STATION, HAWAII.

Purpose.—Change of characteristic and installation of an incandescent oil-vapor system made it necessary to assign an assistant keeper to this station. For the accommodation of the assistant keeper a small two-room temporary structure was constructed, but this arrangement was not satisfactory or sanitary, in consequence of which the need of a proper dwelling was urgent.

Site.—The new dwelling is located upon the light station reservation about 275 feet north 30° west from the tower. The concrete piers for the footings are laid upon solid coral formation which has an average elevation of 3 feet above high water, the whole forming an excellent foundation.

Structure.—The dwelling is a single frame building of four rooms, bath, pantry, storeroom, and two closets. It has plastered interior, shingled roof, is fitted with complete plumbing and water systems, and is screened on all exterior openings.

Cost.—The building was constructed from an allotment of funds from appropriation "Light keepers' dwellings," provided by act of May 27, 1908. The work was carried out by the purchase of materials and use of hired labor and was completed June 26, 1915. Total amount expended to June 30, 1915, \$3,198.96.

THIMBLE SHOAL LIGHT STATION, VA.

Purpose.—This station was originally built, in 1872, to take the place of the Willoughby Spit Light Vessel and to mark a shoal spot called "The Thimble" which is a great source of danger to vessels navigating the bay and coming in from the sea. The present structure which went into commission December 1, 1914, was built to take the place of the one destroyed by fire in 1909.

Site.—The site is located on the shoalest point of Horseshoe Bar at the entrance to Hampton Roads, Chesapeake Bay, about $3\frac{1}{4}$ miles northeast of Old Point Comfort, Va. Borings made at the site for a depth of 28 feet below the bottom showed hard, fine white sand for the entire depth.

Structure.—The structure consists of a cast-iron pier filled with concrete, 42 feet in diameter at the bottom, reducing upward to 30 feet in diameter at the top of the third course of plates, and curving out into a trumpet-shaped top whose deck is 38 feet 6 inches in diameter and 18 feet 9 inches above mean high water. The deck supports a three-story conical cast-iron dwelling upon the roof of which is a fourth-order cylindrical, helical-bar lantern whose focal plane is 36 feet 6 inches above the main deck. The latter is protected by a railing and covered by a veranda roof whose outer diameter is supported by columns, and there is a second circular railing on the roof of the dwelling. The cast-iron pier was assembled on shore at Berkley, Va., launched by a marine railway, towed out to the site and sunk by the pneumatic process 12 feet 9 inches into the bottom of the bay; 350 tons of the riprap were deposited on the bottom for a distance of 25 to 30 feet out from the caisson, and an additional amount yet remains to be placed.

Illuminating apparatus.—The illuminating apparatus consists of a fourth-order fixed lens of six panels revolving on ball bearings, driven by a standard fourth-order clock and showing a characteristic of fixed white one second, eclipse one second. The occultations are produced by blanketing the alternate panels with spherical mirrors which serve to intensify the light in the opposite panel. The intensity of the light is 46,000 candles, the focal plane is 55 feet 3 inches above mean high water, and the light is visible 13 miles in clear weather. The light is furnished by a 35 millimeter, type B, double tank, incandescent oil-vapor lamp.

Fog signal.—The fog signal consists of a third-class reed horn blown by compressed air. The compressing plant is in duplicate and consists of two 12 horsepower kerosene engines and compressors, direct connected, on the same bed. The characteristic is two seconds blast, four seconds silent interval. There are storage tanks for holding a reserve supply of air for immediate use. There is one vertical mushroom trumpet located above the roof of the lantern.

Quarters.—There are quarters for three keepers. Below the floor of the basement there are two cisterns. The basement contains the engine room, coal and wood rooms, oil vault, provision room, and water-closet. There are two large cargo doors in the basement. The first floor contains the main entrance hall, kitchen, living room, closets and pantry. The second floor contains two bedrooms, a storeroom, and closets. The third floor contains a bedroom and watchroom, both with closets. An inclosed stair cylinder with four flights of stairs extends from the basement floor to that of the lantern. Supplies are landed directly at the station by the tender. There are two landing platforms and ladders, and two sets of davits for hoisting the boats.

Cost.—The station was constructed under the acts of June 25, 1910, and August 26, 1912, appropriating a total of \$107,000 for the rebuilding of the light and fog signal at this point. The work was carried out under two contracts and cost \$99,952.76. The work was started in December, 1912, and was practically completed December 1, 1914. Some protective riprap work remains to be done.

LIGHTHOUSE TENDER "FERN."

Purpose.—The tender *Fern* was built for general lighthouse service in the inside waters of the sixteenth lighthouse district, southeastern Alaska.

Structure.—This tender is 112 feet overall, with a molded beam of 22 feet, and a displacement of 253 tons when floating at a mean draft of 7 feet 3 inches in salt water. The entire vessel, with the exception of the machinery room casing, is built of wood, fitted with water-tight bulkheads. A derrick mast and boom, complete with steam hoister, are fitted forward of the buoy deck.

Machinery.—The propelling machinery consists of one triple-expansion surface condensing engine of the vertical inverted type, having cylinders 10, $17\frac{1}{2}$, and 28 inches in diameter by 18-inch stroke, driving a bronze propeller 6 feet 4 inches in diameter

by 8 feet 3 inches pitch, and supplied with steam under a pressure of 200 pounds by an Almy water-tube boiler using oil as fuel, having 42 square feet of grate surface and 1,790 square feet of heating surface. The tender is fitted throughout with all modern appliances, including steam windlass, sanitary plumbing and fixtures, drainage system, and electric-lighting system.

Quarters.—The complement of the tender is four officers and eight men. The officers' quarters and mess room, also galley, storerooms, and bathrooms are on the main deck, while on the upper deck are the master's quarters and pilot house. On the main deck aft is a stateroom and saloon for the inspector or other official passengers. Quarters for eight men are located forward, entirely above the water line, under the top-gallant forecastle deck. Four additional berths are provided, and located on the main deck. The cargo hold is located under the buoy deck and has a capacity of 25 tons.

Cost.—This tender was constructed under the acts of May 27, 1908, and March 4, 1909, appropriating \$200,000, amended by act of July 27, 1912, authorizing the use of this amount for the construction of two tenders for general service. The vessel was built under contract at Winslow, Wash., and the cost was \$62,100.35. The construction was commenced June 11, 1914, and the vessel completed and placed in commission June 25, 1915. On July 1, 1915, the tender left Seattle, Wash., for her station in Alaska, arriving at Ketchikan, Alaska, July 4, 1915.

LIGHTHOUSE TENDER "LAUREL."

Purpose.—The tender *Laurel* was built for general lighthouse service in the shoal waters of the Chesapeake Bay and tributaries, fifth lighthouse district.

Structure.—This tender is 104 feet 6 inches overall, with a molded beam of 22 feet, and a displacement of 218 tons when floating at a mean draft of 6 feet 1 inch in salt water. It is a single-deck vessel, constructed entirely of wood, with the exception of three steel water-tight bulkheads. A derrick mast and boom, complete with steam hoister, are fitted at the after end of the buoy deck.

Machinery.—The propelling machinery consists of one triple-expansion, inverted, direct-acting engine, having cylinders 8, 13, and 21 inches in diameter by 16-inch stroke, driving a cast-iron propeller 5 feet 8 inches in diameter by 6 feet 3 inches pitch, and supplied with steam under a pressure of 200 pounds per square inch by one Almy water-tube boiler, using coal as fuel, having 30 square feet of grate surface and 950 square feet of heating surface. The tender is fitted throughout with all modern appliances, including sanitary plumbing and fixtures, and drainage system, but has no electric-lighting system.

Quarters.—The complement of the tender is four officers and eight men. The officers' quarters are located on the upper deck aft of the pilot house. The officers' mess room, galley, storerooms, and bathrooms are on the main deck, also a stateroom for the inspector or other official passengers. Quarters for six men are located under the main deck aft. The cargo hold is located under the buoy deck and has a capacity of 15 tons.

Cost.—This tender was constructed under the act of March 4, 1907, appropriating \$60,000. The vessel was built under contract at Baltimore, Md., and the cost was \$55,522.15. The construction was commenced October 31, 1913, and the vessel completed and placed in commission May 21, 1915, at Baltimore, Md.

LIGHT VESSEL "No. 96."

Purpose.—Light vessel No. 96 was on April 24, 1915, placed on station at Poe Reef, southern entrance to Straits of Mackinac, Lake Huron, Mich., in the eleventh lighthouse district.

Structure.—The vessel is 101 feet overall, with a molded beam of 23 feet 6 inches, and a displacement of 260 tons when floating at a mean draft of 10 feet 9 inches in fresh water. The entire vessel is built of steel with upper deck throughout of the turtle-deck type. A steel house is located on the upper deck for chart room and pilot house. One steel lantern mast, of diameter sufficient to contain a ladder giving access to the lantern is fitted. Ballasted bilge keels, of the box-section type, for minimizing rolling are fitted.

Illuminating apparatus.—The signal light is housed in a lantern at the head of the steel mast. It consists of an incandescent electric light in a parabolic reflector; the reflector is revolved to show a flash, and the intensity of the light is equal to 1,000 candles. The focal plane is 42 feet above the water.

Fog signal.—This apparatus consists of a 6-inch mechanically operated air siren, connected to high pressure air-storage tanks supplied by two compressor units, each

unit being a 3-cylinder air compressor driven by internal combustion motor using kerosene as fuel. A submarine bell, actuated by compressed air, is also fitted.

Machinery.—This vessel is nonpropelling, but is fitted with a stern tube to enable the installation of propelling machinery, if desirable at any future time. The vessel is fitted throughout with all modern appliances, including windlass, sanitary plumbing and fixtures, and drainage system, and electric-lighting system using oil-driven generator and storage batteries.

Quarters.—The complement of the vessel is three officers and three men. The officers' and crew's quarters, galley, mess rooms, pantries, bathrooms, lamp room, and other miscellaneous storerooms are located on the main deck.

Painting.—The hull is red with POE in large white letters on each side.

Cost.—This light vessel was constructed under the act of March 4, 1911, appropriating \$75,000. The vessel was built under contract at Muskegon, Mich., and the cost was \$71,218.73. The construction commenced April 24, 1913, and completed, and the vessel delivered to the Government on October 23, 1914.

LIGHT VESSEL "No. 98."

Purpose.—Light vessel No. 98 was, on June 12, 1915, placed on station at the entrance to Buffalo Harbor, Lake Erie, N. Y., tenth lighthouse district.

Structure.—The vessel is 101 feet overall, with a molded beam of 23 feet 6 inches, and a displacement of 260 tons when floating at a mean draft of 10 feet 9 inches in fresh water. The entire vessel is built of steel, with upper deck throughout of the turtle-deck type. A steel house is located on the upper deck for chart room and pilot house. One steel lantern mast, of diameter sufficient to contain a ladder giving access to the lantern, is fitted. Ballasted bilge keels, of the box-section type, for minimizing rolling are fitted.

Illuminating apparatus.—The signal light is housed in a lantern at the head of the steel mast. It consists of an incandescent electric light in a parabolic reflector; the reflector is revolved to show a flash, and the intensity of the light is equal to 1,000 candles. The focal plane is 42 feet above the water.

Fog signal.—This apparatus consists of a 6-inch mechanically operated air siren, connected to high pressure air-storage tanks supplied by two compressor units, each unit being a 3-cylinder air compressor driven by internal-combustion motor using kerosene as fuel.

Machinery.—The propelling machinery consists of one 4-cylinder, 100 horsepower Mietz & Weiss kerosene oil engine of the reversible type, having cylinders 10 inches in diameter by 12-inch stroke, making 340 revolutions per minute, driving a propeller 4 feet in diameter by 3 feet 4 inches pitch. The vessel is fitted throughout with all modern appliances, including windlass, sanitary plumbing and fixtures, and drainage system, and electric-lighting system using oil-driven generator and storage batteries.

Quarters.—The complement of the vessel is four officers and two men. The officers' and crew's quarters, galley, mess rooms, pantries, bathrooms, lamp room, and other miscellaneous storerooms are located on the main deck.

Painting.—The hull is red, with BUFFALO in large white letters on each side.

Cost.—This light vessel was constructed under the act of August 26, 1912, appropriating \$250,000. The vessel was built under contract at Muskegon, Mich., and the cost was \$89,229.33. The construction commenced April 24, 1913, and the vessel was delivered to the Government on May 29, 1915.

**SUMMARY OF IMPORTANT CONSTRUCTION AND REPAIR WORK UNDER
GENERAL APPROPRIATIONS, COMPLETED DURING FISCAL YEAR 1915.**

Station.	Cost.	Character of work.
FIRST DISTRICT.		
Little Diamond Island Lighthouse Depot, Me.	\$4,717	General repairs to wharf, dwellings, storehouse, barn, and outbuildings.
Stockton Harbor Range Lights, Me.....	4,877	Establishment of range lights on skeleton steel towers.
SECOND DISTRICT.		
Gallups Island Light and Fog Signal Station, Mass.	1,740	Installation of light and fog signal.
Middle Ledge and Grassy Island Ledge Lights, Mass.	1,928	Installation of acetylene in place of oil lights.
THIRD DISTRICT.		
General Lighthouse Depot, N. Y.....	1,030	Installing heating system and repairs to offices.
Rhinnecock Bay Light Station, N. Y....	7,332	Improvements to illuminating apparatus.
Stratford Shoal, N. Y.....	5,467	Installation of new fog-signal plant and alterations to station.
Watch Hill Light Station, R. I.....	3,336	Concrete shore protection.
FOURTH DISTRICT.		
Cape Henlopen Light Station, Del.....	3,816	Timber groynes and bulkhead for shore protection.
Salem River Rear Range Light.....	1,338	Mast and acetylene lantern established.
Brandywine Shoal Light Station, Del..	8,901	Riprap deposited around station to prevent scour.
Chester Range Lights, Del.....	1,243	Establishing range lights.
Listons Range Front Light, Del.....	2,284	Riprap, groyne, and sea wall for shore protection.
FIFTH DISTRICT.		
Point Lookout Lighthouse Depot, Md.	6,614	Removing old and building new wharf.
Portsmouth Lighthouse Depot, Va.....	4,689	Repairs to wharf.
Lazaretto Lighthouse Depot, Md.....	3,375	Repairs to wharf and installation of new motor-driven machinery.
SIXTH DISTRICT.		
Georgetown Light Station, S. C.....	3,408	Construction of boathouse, storehouse, fence, and minor repairs.
St. Andrew Sound Light, Ga.....	3,423	Establishment of acetylene light on concrete pile substructure.
Fort Sumter Range Front Light, S. C...	2,852	Establishment of acetylene light on concrete pile substructure.
Hilton Head Range Front Light, S. C..	1,291	Installation of acetylene light.
Sapelo Light Station, Ga.....	2,839	Construction of new boathouse and fence and minor repairs.
Hunting Island Light Station, S. C.....	1,081	New cement walks and general repairs to storehouse and dwelling.
St. Simon Light Station, Ga.....	1,122	New cement walks and general repairs to tower and dwelling.
SEVENTH DISTRICT.		
Carysfort Reef Light Station, Fla.....	1,191	General repairs to tower.
Egmont Key Range Front Light, Fla..	5,233	Establishing an acetylene light on a reinforced concrete pile substructure.
Key West Light Station, Fla.....	1,555	Changing illuminant from oil to acetylene and making general repairs.
Mosquito Bank Light, Fla.....	1,009	Changing illuminant from oil to acetylene.
North Bank Light, Fla.....	4,705	Establishing an acetylene light on a reinforced concrete pile substructure.
EIGHTH DISTRICT.		
Bunch Timber Range, Lower and Upper Pritchard Long Points, Hurricane Crossing Range, Cobbs Point, Boggy Bayou, and Four Mile Point Lights, Fla.	2,078	Establishment of 9 post lantern lights.
Cape San Blas, Fla.....	4,508	Shore protection and cofferdam around tower.
Galveston Bar Gas and Whistling Buoy, Tex.	4,850	Establishment of gas and whistling buoy.
Galveston Bay Channel Entrance Range and Galveston Bay Channel Lights Nos. 3A, 2A, and 4A, Tex.	7,531	Establishment of 5 acetylene lens lantern lights.
Long Point Light, La.....	1,097	Rebuilding structure.
Mobile Ship Channel Light No. 8C, Ala.	1,625	Establishment of 1 acetylene lens lantern.
Pass Aux Herons Channel Lights Nos. 2, 4, 6, and 8 and Beacons 2, 4, and 6, Ala.	3,916	Establishment of 4 lens lantern lights and 3 day beacons.

SUMMARY OF IMPORTANT CONSTRUCTION AND REPAIR WORK UNDER GENERAL APPROPRIATIONS, COMPLETED DURING FISCAL YEAR 1915—Continued.

Station.	Cost.	Character of work.
NINTH DISTRICT.		
Puntilla Point, San Juan Depot, P. R.	1,172	Riprap for shore protection.
Catano Range Front Light, P. R.	3,039	Establishment of low-pressure acetylene light and generator house on reinforced concrete pile substructure.
Anegado Shoal Range Front Light, P. R.	2,764	Do.
Anegado Shoal Range Rear Light, P. R.	2,866	Do.
Ponce Harbor Range Front Light, P. R.	2,164	Do.
TENTH DISTRICT.		
Carleton Island Light, N. Y.	3,250	Establishment of acetylene light on steel tower.
Buffalo South Pier, N. Y.	2,467	Establishment of electric light and fog bell on steel tower.
Presque Isle Pierhead, Pa.	1,775	Increasing height of Erie range light No. 2 and general improvements.
Presque Isle, Pa.	5,194	Rebuilding boathouse, reroofing dwelling, and building 7,000 feet of elevated walk.
Conneaut West Breakwater Light, Ohio	1,651	Establishment of acetylene light on steel tower.
Ashtabula West Breakwater Pierhead Light, Ohio.	1,117	Establishment of temporary acetylene light.
Cleveland East Breakwater East End Light, Ohio.	1,692	Establishment of acetylene light on steel tower.
Lorain East Breakwater Pierhead Light, Ohio.	1,095	Repairing steel tower and reestablishment of light.
Sandusky Depot, Ohio.	5,877	Rebuilding buoy wharf.
Manhattan Range, Ohio.	2,952	Changing illuminant from oil to oil gas.
ELEVENTH DISTRICT.		
Peach Island Range Lights, Mich.	1,262	Changing illuminant from oil to acetylene.
Fort Gratiot Light Station, Mich.	9,423	Shore protection and minor improvements.
Port Austin Reef, Mich.	2,079	New concrete dock, windmill, and tank and minor improvements.
Alpena Light Station, Mich.	5,578	Rebuilding crib, replacing frame tower by iron tower, and changing illuminant from oil to electricity.
Detour Light Station, Mich.	3,645	General improvements.
Vidal Shoals Channel Range, Mich.	2,266	Moving rear structure and building new front structure and laying cable to all lights.
Birch Point Range, Mich.	2,800	Moved dwelling over ice from Brush Point, extended sea wall, repaired docks, laid walks, drove well, and other minor improvements.
Stannard Rock Light Station, Mich.	9,500	Building concrete fog-signal house; installing electric fog signal; hoisting engine, boiler, and steam-heating plant; making minor repairs.
Huron Island Light Station, Mich.	2,397	Laying walks, reconstructing tramway, building concrete bridge, and concrete breakwater.
Big Bay Point Light Station, Mich.	1,945	Remodeling old building for keeper's quarters.
Manitou Light Station, Mich.	6,100	Remodeling fog-signal building, replacing steam fog-signal plant by compressed-air plant, rebuilding dock and minor repairs.
Devils Island Light Station, Mich.	2,120	Installing oil-vapor light and strengthening tower.
TWELFTH DISTRICT.		
Calumet Harbor Light Station, Ill.	1,095	Repairing damage done to station by storm.
Chicago Breakwater South Light, Ill.	1,542	Improvement of illuminating apparatus.
Grossepoint Light Station, Ill.	2,679	Encasing brick tower with reinforced concrete.
Manistee Pierhead Light Station, Mich.	2,224	Remodeling fog-signal building and replacing steam boilers with repaired boilers from Waugoshance.
Menominee Pierhead Light Station, Mich.	1,278	Reerecting metal elevated walk taken from Sheboygan North Pierhead.
Muskegon North Pierhead Light, Mich.	1,737	Establishing acetylene light on steel tower.
Saugatuck North Pierhead, Mich.	2,939	Do.
Squaw Point Light Station, Mich.	1,537	Changing illuminant from oil to acetylene.
St. Joseph Pierhead Light Station, Mich.	3,098	Construction of sea wall, filling grounds, and laying concrete walks.
SEVENTEENTH DISTRICT.		
Alki Point Light Station, Wash.	1,245	The stone revetment at this station was strengthened by the placing of 420 tons of stone.
Cape Meares Light Station, Oreg.	3,329	Dwellings were repaired throughout, complete new plumbing put in, new shop and storehouse built, barn repaired, new cement walks laid, and grounds drained.
Heceta Head Light Station, Oreg.	2,575	Dwellings were repaired throughout, complete plumbing put in, new water-supply pipe laid, fences renewed, and road surfaced and ditched.

SUMMARY OF IMPORTANT CONSTRUCTION AND REPAIR WORK UNDER GENERAL APPROPRIATIONS, COMPLETED DURING FISCAL YEAR 1915—Continued.

Station.	Cost.	Character of work.
SEVENTEENTH DISTRICT—continued.		
North Head Light Station, Wash.....	1,395	The oil houses roofs were renewed, roofs of dwellings repaired and exterior walls cemented and painted, and plaster work and inside finish repaired and renewed.
Umpqua River Light Station, Oreg....	4,053	A new water and sewerage system was installed, including pumping plant and storage tank, dwellings repaired and complete plumbing put in, boat house constructed, barn and fences repaired.
Point No Point Light Station, Wash...	1,260	Fourth-order group flashing l. o. v. illuminating apparatus installed.
West Point Light Station, Wash.....	2,756	New water and sewerage system put in, dwellings repaired and remodeled, including complete plumbing throughout.
Tongue Point Depot, Oreg.....	7,410	Concrete retaining wall rebuilt for a length of about 300 feet and 8,000 cubic yards of fill made; about 800 tons of riprap were placed to protect wall.
EIGHTEENTH DISTRICT.		
Trinidad Head Light Station, Cal.....	1,406	Installing a water supply and storage system.
Angel Island, Cal. (Point Blunt Light; Point Stuart Light).	5,343	Installation of electric lights and electric fog signals controlled from Angel Island Station; also enlarging keepers quarters at Angel Island Station.
Point Reyes Light Station, Cal.....	6,806	Compressed-air sirens and 15-horsepower gas engines replaced by large type Diaphone and 30-horsepower engines.
Inner Harbor Fog Signal, Los Angeles, Cal.	2,482	Installation of fog bell and electrically-wound striker.
San Louis Obispo Light Station, Cal...	2,933	Steam fog signal replaced by compressed air automatic siren, gas engines, and air compressors.
Point Sur Light Station, Cal.....	3,389	Building wharf and tramway.
NINETEENTH DISTRICT.		
Keahole Point, Hawaii.....	2,365	Built new 30-foot reinforced concrete tower and changed old lens lantern light to flashing acetylene light.
Barbers Point, Hawaii.....	2,299	Installed 3.6 miles of 14-inch pipe for sanitary water supply and erected intake and station distribution tanks.
Laupahoehoe Point, Hawaii.....	2,070	Built new 30-foot reinforced concrete tower and changed old lens lantern light to flashing acetylene light.
Kawaihae, Hawaii.....	2,144	Built new 34-foot reinforced concrete tower and changed old lens lantern light to flashing acetylene light.
Mahukona, Hawaii.....	2,060	Built new 20-foot reinforced concrete tower and changed old lens lantern light to flashing acetylene light.
McGregor Point, Hawaii.....	2,182	Do.

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AIDS TO NAVIGATION.

During the fiscal year ended June 30, 1916, there was a net increase of 412 in the total number of aids to navigation maintained by the Lighthouse Service, including 45 lights above the order of minor lights, 5 fog signals, 2 submarine bells, 67 daymarks, 33 lighted buoys, 171 unlighted buoys, and 91 minor lights (including 7 float lights).

Fixed lights were changed to flashing or occulting at 49 stations. The illuminant of 19 lights was changed to incandescent oil vapor, the illuminant of 44 lights (including 2 light vessels) was changed to acetylene, and the illuminant of 13 lights was changed to electric incandescent.

On June 30, 1916, there were maintained by the Lighthouse Service, 14,947 aids to navigation, including 5,323 lights of all classes, and 584 fog signals (not including whistle and bell buoys), of which 52 are submarine signals. It is believed that the systematic methods of improvement and the use of modern apparatus in increasing the number and brilliancy of aids have been of value to the safety of commerce.

The table following gives a summary of the aids to navigation, under each class, established and discontinued during the fiscal year, and also the net increase, and the number in commission at the end of the fiscal years 1915 and 1916:

Class.	1916			Total June 30—	
	Estab- lished.	Discon- tinued.	Increase.	1915 ^a	1916
Lighted aids:					
Lights (other than minor lights).....	66	21	45	1,661	1,706
Minor lights.....	187	104	83	2,837	2,920
Light-vessel stations.....	1	1	.....	53	53
Gas buoys.....	86	53	33	479	512
Float lights.....	12	4	8	124	132
Total.....	352	183	169	5,154	5,323
Unlighted aids:					
Fog signals.....	7	2	5	527	532
Submarine signals.....	2	.....	2	50	52
Whistling buoys, unlighted.....	1	4	^b 3	86	83
Bell buoys, unlighted.....	14	13	1	237	238
Other buoys.....	354	183	171	6,488	6,659
Day beacons.....	244	177	67	1,993	2,060
Total.....	622	379	243	9,381	9,624
Grand total.....	974	562	412	14,535	14,947

^a Differences from statistics published in 1915 report are due to minor discrepancies in previous count.

^b Decrease.

The following are some of the more important aids which have been established or materially improved during the past fiscal year:

New fourth-order light stations, each with a fog bell, were placed in commission at Rondout North Dikey Hudson River, N. Y., and Point au Fer Reef, Atchafalaya Entrance, La.

A light vessel was established at Stone Horse Shoal, Nantucket Sound, Mass., in place of the vessel formerly stationed at Shovelful Shoal, in the same locality.

An improved system of lighted aids was completed in the channels leading to Baltimore, Md.

Fog signals were established at Windmill Point, Mass. (electric bell); Rondout, N. Y. (bell); Point au Fer Reef, La. (bell); Cleveland East Entrance, Ohio (electric siren); Ashland Breakwater, Wis. (electric siren); and Point Hudson, Wash. (reed horn). The former steam whistle at Cape Ann, Thachers Island, Mass., was changed to a compressed-air diaphone.

A submarine bell was established on Hedge Fence Light Vessel No. 9, Nantucket Sound, Mass.

Important lighted buoys were established in Cape Cod Canal Channel, Mass. (4 buoys, 1 with bell); Negro Ledge, Buzzards Bay, Mass. (bell); No Mans Land, Mass. (whistle); Plum Point, Long Island Sound, N. Y.; Shrewsbury Rocks, N. J. (bell); Cape Fear River Entrance, N. C. (whistle); Mullet Key, Fla. (bell); Santa Elena Shoal, Gallardo Shoal (whistle), and Tourmaline Reef, P. R.; Fighting Island Channel, Detroit River, Mich. (3 buoys); Eagle River Shoals, Lake Superior, Mich. (bell); Clatsop Spit, Oreg.; South Jetty, Oreg. (whistle); Blonde Reef, Hawaii (bell); and Lahaina, Hawaii.

Systems of minor aids and buoyage were extensively rearranged or improved in the following important localities: Plymouth Harbor, Mass.; Cape Cod Canal Approaches, Mass.; Pawcatuck River, R. I.; Baltimore Harbor, Md.; Croatan Sound, N. C.; St. Catherine Sound, Ga.; Nassau Sound, Fla.; Lake Okechobee and connecting waters, Fla.; Manatee River, Fla.; Inside Route, Florida and Texas; Middle Neebish Channel, St. Marys River, Mich.; Oakland Harbor, Cal.; and Pearl Harbor, Oahu, Hawaii.

Flashing acetylene lights were established at Pumpkin Island Reef, Me.; Padanaram Breakwater, Mass.; Canal Channel, Mass. (2); Cuttyhunk North Jetty, Mass.; Point Judith Harbor of Refuge West Breakwater, R. I.; Mattituck Breakwater, N. Y.; Mud Island Range, Pa. (2 lights); Raccoon Creek Range, N. J. (2 lights); Oyster Creek, N. C.; Fort Sumter Range Front, S. C.; Coon Key, Fla.; Manatee River, Fla. (3 lights); Linda Island, N. Y.; Ballast Island, Ohio; St. Clair Flats Canal Range, Mich. (2 lights); Manistee South Breakwater, Mich.; Sheboygan South Pierhead, Wis.; Barren Island, Point McCartney, Lewis Reef, Moira Rock, Rosa Reef, Narrow Point, Point St. Albans, Middle Point, Point Alexander, Point Gambier, Marmion Island, Sheep Creek, Clear Point, Barlow Islands, Naked Island, Little Island, Low Point, Kingsmill Point, Point Augusta, Hawk Inlet Entrance, Hawk Inlet East Shoal, Otstoia Island, McClellan Rock, Seal Rocks, Gray Cliff, Anchor Point, East Forelands, East Chugach, Flat Island, Race Point, and Point Romanoff, Alaska; Iceberg Point, Wash.; and Waterman Point, Wash.

Mention should be made of the first flashing acetylene lights in the river districts, established on Keokuk Lake, Mississippi River, above the dam at Keokuk, Iowa. Three lights were established as follows: Galland and Fort Madison Float Lights, Iowa, and Waggoner Point, Illinois.

The fiscal year was marked by the unusual phenomenon of three severe tropical hurricanes on the Gulf coast, all occurring within a period of approximately six weeks. The first of these storms prevailed on August 16 to 17, 1915, in the vicinity of Galveston, Tex.; the second was on September 3 to 4, 1915, near Apalachicola, Fla.; and the third occurred on September 28 to 29, near New Orleans, La. No lives of persons in the Lighthouse Service were lost during

any of these storms, but the damage to lighthouse property was very great and widespread, a large number of stations and vessels in the eighth lighthouse district being damaged, while many small lights and other structures were completely destroyed. The total damage amounted to about \$212,000. A special appropriation of \$200,000 was made by Congress by the act of February 28, 1916, toward repairing and rebuilding the aids to navigation affected by these storms. It should also be noted that immediately after the close of the fiscal year, on July 5 to 6, 1916, another severe storm visited the Gulf coast in the general vicinity of Mobile, Ala., damaging lighthouse property to the extent of approximately \$140,000. This matter was also brought to the attention of Congress and an appropriation of \$125,000 was made by the act of September 8, 1916, for this work.

To assist in obtaining prompt information as to defects in aids, a form of post card has been devised for the use of mariners, printed in such form that it is only necessary to insert the name of the aid reported, with date, time, and by whom observed, and forward to the lighthouse inspector concerned.

A general inquiry was made during the year respecting means of communication, by telegraph and telephone, between light stations and various commercial centers.

At the end of the fiscal year a plan was under investigation for the sale of light and buoy lists at a nominal price in cooperation with the Superintendent of Documents and the Division of Publications of the Department.

Arrangements were made to continue a number of buoys on stations throughout the year, instead of removing them in winter, as heretofore, because of ice conditions. This plan has been very satisfactory to mariners using the waters affected. Also on account of the unprecedented amount of shipping on the Great Lakes, arrangements were made to continue aids to navigation as late as possible, consistent with the safety of employees and property of the service.

During the fiscal year the standardization of the Atlantic, Lake, and Pacific coast light and buoy lists was completed. All of these publications are now in octavo form and effort has been made to publish them at regular and definite intervals.

ALASKA.

The total number of aids to navigation in Alaska, including lights, fog signals, buoys, and daymarks, in commission at the close of the fiscal year ended June 30, 1916, was 388, including 147 lights, representing an increase of 110 lights since June 30, 1910, or over 297 per cent. The following table, which gives the total number of aids to navigation on June 30 of each year named, illustrates the progress in establishing aids in the Territory:

Aids.	1910	1911	1912	1913	1914	1915	1916
Lights.....	37	71	85	93	108	112	147
Fog signals.....	9	10	10	10	10	10	11
Buoys.....	84	105	132	136	157	167	181
Daymarks.....	30	29	38	40	44	49	49
Total.....	160	215	265	279	319	338	388

The act of October 22, 1913, made an appropriation of \$115,000 for a light and fog-signal station at or near Cape St. Elias, and an item for the establishment of aids to navigation and the improvement of existing aids in Alaska, in the sum of \$60,000, was included in the sundry civil act approved August 1, 1914. Work on both of these objects was started as promptly as conditions would permit, and good progress has been made. Due to exceptional weather conditions an entire year has been gained in the building of the Cape St. Elias lighthouse, which will probably go in commission during the fall of 1916. Under the appropriation for Alaskan aids, 36 new lights were established in addition to other needed improvements.

The new lighthouse tender *Cedar*, for which \$250,000 was appropriated by the act of January 25, 1915, was under construction at Long Beach, Cal., during the fiscal year. The completion of this vessel has been delayed by causes beyond the control of the Lighthouse Service. In the meantime the tenders *Kukui* and *Fern* continue to care for lighthouse work in Alaska.

GUANTANAMO, SAMOA, AND GUAM.

The aids to navigation in the outlying United States territory at Guantanamo Bay, Cuba, the American Samoan Islands, and the island of Guam are maintained under the supervision of the naval commandants by means of allotments made from the appropriations for the Lighthouse Service. Reports have been received from naval officers in local charge, indicating that the aids have been properly maintained, at an approximate annual expense as follows: Guantanamo, \$3,200; Samoa, \$1,050; Guam, \$370.

In addition to the duty of maintaining the aids to navigation, the commandant of the Naval Station at Guantanamo Bay rendered valuable assistance to the Lighthouse Service by his cordial cooperation in connection with lighthouse construction work at Navassa Island, West Indies, which is remote from any other United States possession.

ENGINEERING AND CONSTRUCTION.

New works of principal importance under special appropriations completed during the fiscal year are as follows: Point Judith Breakwater lights, Rhode Island; Fort McHenry channel lights, Maryland; Norfolk Harbor lights, Virginia; Atchafalaya Entrance lights, Louisiana; and Ashland Breakwater light and fog signal, Wisconsin.

Other important work in progress at the close of the fiscal year includes: New carpenter shop at the general depot, Tompkinsville, N. Y.; Charleston Lighthouse depot, South Carolina; Galveston Jetty light and fog signal, Texas; Navassa Island light station, West Indies; Ashtabula, Cleveland, and Lorain light stations, Ohio; Manistique light and fog signal, Michigan; and Cape St. Elias light and fog signal, Alaska.

Owing to the large and constantly increasing amount of concrete now being used in lighthouse work, it appeared advisable for the Lighthouse Service to adopt a general specification for guidance in designing and erecting concrete structures. It was decided after a careful study of the matter to adopt the principles laid down in Progress Report of Special Committee on Concrete and Reinforced Concrete as printed in Proceedings of the American Society of Civil

Engineers, February, 1913, for use in the Lighthouse Service so far as practicable.

Revised photolithographic drawings and printed specifications for standard steel skeleton towers, superseding previous editions, were issued during the year.

Several interesting features in connection with improvements and changes at various light stations involved the handling of unusual weights, which was accomplished without accident. At Sheboygan, Wis., on Lake Michigan, an entire cylindrical steel tower, weighing approximately 30 tons, was transferred from one pier to another, and near Georgetown, S. C., an entire keeper's dwelling with chimneys and piazza complete, weighing about 115 tons, was moved across Winyah Bay.

The most important items of construction work now under way are the new lighthouses for Cape St. Elias, Alaska, and Navassa Island, West Indies. While far apart in location, these stations present somewhat similar problems by reason of their unusual remoteness and inaccessibility, under widely different conditions. The station at Cape St. Elias will be of concrete and hollow tile, with a double flashing white light and powerful fog signal, while that at Navassa will be an unusually tall reinforced concrete tower (150 feet) showing a double flashing white light.

Constant attention has been given in renewals and replacements to the use of more permanent materials, such as concrete beams for those formerly of timber, asbestos instead of wooden shingles, etc.

Certain keeper's dwellings, located near fortifications, have frequently suffered damage by concussion due to artillery practice. In order to avoid this, steps have been taken to provide additional scuttles in roofs and removable casings to chimneys, with satisfactory results for guns of moderate caliber.

IMPROVEMENT OF APPARATUS AND EQUIPMENT.

A standard tool chest for use at light stations, containing all tools required by keepers for ordinary repair work, has been designed and equipped at the general depot. A similar chest, fitted with pipe and machine tools, for use at fog signal stations, is also under consideration.

A device for automatically replacing burned-out incandescent electric lamps has been developed and is now in use at several stations. It consists briefly of three lamp sockets mounted radially at 120° on a spring-actuated shaft so that the upper lamp is in the focus of the lens. Should the lamp in service burn out, an electromagnet releases a latch, and the shaft revolves 120° , bringing the second lamp in service. Should this lamp also burn out, the third and final lamp is similarly thrown in circuit.

Several remote electrically operated light and fog-signal stations have been placed in operation. Duplicate lamps are provided, with automatic cut-in for the spare lamp, and an arrangement of magneto relays in conjunction with a telephone enables the keeper to use the circuit as a telltale for observing the operation of the fog signal.

For the purpose of obtaining more distinction between second and third class nun buoys, a new and larger design of the second-class buoy has been prepared, from which a trial buoy is now being built for test. This will be adopted as a new model if the tests prove successful.

As a result of complaints received from the residents of a large city in regard to the sound of a fog signal in the adjacent harbor being objectionable to them, a sound deflector was installed at the station which has proven effective in minimizing the sound of the signal on shore.

A portable steel plate davit bracket, for quick attachment to a lighthouse tender when engaged in mine-planting drill, has been designed and constructed at the general depot.

Experiments were made to investigate the reliability and degree of accuracy to be expected in obtaining distances at sea by observing the elapsed time between radio and aerial, or radio and submarine, signals dispatched simultaneously. After several trials it was found that the comparatively short ranges of the whistle or submarine bell under service conditions led to such a brief receiving interval between such signals and radio signals as to make highly accurate observations by stop watch a necessity, thus limiting the use of such a method from a practical standpoint.

In the case of a fog signal operated by internal-combustion engines, where it was found that considerable vibration was caused the structure while the machinery was in motion, additional counterweights were attached to the counterpoise of each flywheel and the speed of the engine increased, with the result that the vibrations were eliminated.

An improvised plane-table method has been used for locating positions of beacon lights by graphic methods, thus dispensing with the necessity for the measurement of the horizontal angles by sextant or theodolite. A tracing is prepared and the angles transferred by plotting on the chart.

Standard power boats have been designed and built for use at various island stations in the Great Lakes, and after a season's service have proven to be good sea boats and well adapted for the use intended.

The Navy Department has given notice of the experimental installation of a radio direction finder at the radio station near Cape Cod Light Station, Mass. The purpose of this device is to ascertain by radio the true bearing of a ship from the station and to communicate that information back to the ship by radio.

Two semaphore signals, the first of their kind employed in the United States Lighthouse Service, have been installed in the Livingstone Channel, Detroit River, Mich., for the purpose of assisting vessel masters in obeying a War Department navigation regulation which requires a time interval of not less than five minutes between downbound vessels using that channel. By a proper arrangement of lights, the signals may be used by night as well as by day.

Radio stations have been installed by the Lighthouse Service in connection with the building of Cape St. Elias and Navassa Island Light Stations, to which reference has already been made. These prove of great value in conducting construction operations in such distant localities.

A small-sized mercury float, weighing about 1,000 pounds, has been designed and built at the general depot for use in lenses of the fourth order and smaller sizes.

Electrically operated flashers, intended chiefly for gas lights on light vessels, have proven very satisfactory, especially for relief vessels, whereby the exact characteristic of any station vessel may be quickly reproduced. This is of special benefit in case of accident to a light vessel, when it may be necessary to relieve the station ship immediately.

A comparative test, lasting several months, was made of the types A and B oil-vapor lamps, under varying conditions of temperature, draft, etc., from which it was concluded that both types are quite reliable with proper attention.

The new type of post lantern, designated type B, has been issued in considerable numbers and has given satisfaction in withstanding the highest winds, yielding at the same time a satisfactory candlepower. Experiments are in progress toward the development of a single-wick burner, instead of a double wick, for this lantern.

The electric fog bell strikers recently developed have continued to give good service. Additional lots have been made up and repair parts are kept on hand for issue when needed.

Cast-iron fog signal horns have been designed to overcome the destructive effects of the vibrations on copper horns at stations where unusually powerful signals have been installed.

Standardization of apparatus and repair parts has been kept constantly in mind in planning new installations, and it is believed that this practice will result in a saving in the expense of future work.

A new type of gas buoy, designed by the Lighthouse Service, known as type S, and intended for shoal water, was completed, tested, and found satisfactory for use in suitable localities where a small light is sufficient.

Standard specifications for acetone were compiled and distributed among lighthouse inspectors, in connection with the purchase of dissolved acetylene for illuminating apparatus.

Photolithographic drawings of various types of incandescent oil-vapor lamps, oil engine torches, and post lanterns were prepared during the year and issued to the district offices.

In order to plan ahead as far as possible the installation of new boilers on vessels, special instructions were given in relation to rigid examination of all boilers now in service, in order that repairs might be conducted at opportune times.

Experiments were conducted at the general depot to determine the required amounts of denatured alcohol reasonably necessary for starting the various types of oil-vapor lights in use by the Service, so as to provide a basis for estimating supplies needed at the stations.

An inquiry was made as to methods in vogue in the various districts for mooring large buoys, with particular reference to the use of swivels, and as a result suitable instructions were issued to make the practice more uniform.

Experiments were made to determine the volume of air consumed per second of blast in reed horn fog signals blown at different pressures, and the results communicated to the inspectors, for use in designing future installations.

PERSONNEL.

The following table gives the number of employees (all authorized positions, including some vacancies) of the Lighthouse Service at the end of the fiscal year and a comparison of the totals with those for the previous fiscal year:

EMPLOYEES IN THE LIGHTHOUSE SERVICE ON JUNE 30, 1916.

District.	Inspectors, engineering force, draftsmen, aids, appointed foremen, and mechanics.	Clerks, messengers, janitors, and office laborers.	Depot keepers and assistants, including laborers.	Light keepers and assistants.	Laborers in charge of lights (appropriation "Salaries, keepers of lighthouses").	Laborers in charge of post lights and buoys (appropriation "General expenses").	Custodians of reservations.	Officers and crews on tenders and light vessels.	Field force for construction and repair (registered).	Field force for construction and repair (unregistered).	Total.
Bureau.....	19	26									45
First.....	3	6	1	114	2			67	8	12	213
Second.....	4	7	2	78	11			205	3	8	318
Third.....	22	28	10	180	32	57	2	268	170	44	813
Fourth.....	5	5	3	56	8	5	6	29	5	10	132
Fifth.....	10	9	17	172	95	22	1	249	7	26	608
Sixth.....	4	7	2	55	9	26		118	3	20	253
Seventh.....	2	3	1	41	1	7		25	7	17	104
Eighth.....	6	8	5	109	27	34		94	9	44	336
Ninth.....	2	5	1	34	4			21	16	6	89
Tenth.....	7	5	2	66	2		1	33	4	17	137
Eleventh.....	8	6	6	157	11	2	1	108	17	32	348
Twelfth.....	7	6	6	160	15	2	1	90	7	20	314
Thirteenth.....	1	2				323					326
Fourteenth.....	1	2				540					543
Fifteenth.....	1	2				374		18			395
Sixteenth.....	5	5	1	33		15		44	1	47	151
Seventeenth.....	6	6	4	78	15	113		107	5	11	345
Eighteenth.....	6	6	7	113	7	4		91	5	6	245
Nineteenth.....	4	2	1	27	2			25	3	11	76
Total, 1916.....	123	147	69	1,473	241	1,524	12	1,592	270	340	5,791
Total, 1915.....	123	145	71	1,471	226	1,556	12	1,605	278	305	5,792
Increase.....		2		2	15					35	
Decrease.....			2			32		13	8		1

ADMINISTRATION METHODS AND ECONOMIES.

A third annual conference of lighthouse inspectors, authorized by the Secretary of Commerce, was held during January and February, 1916. The program followed the previous general lines and the results are believed beneficial to the Service.

A new edition of the Instructions to Employees, conforming to the revised regulations, was issued during the fiscal year for the guidance of persons in the Lighthouse Service.

Systematic inspections of the various lighthouse districts by the general inspector, examiner, and officers of the Bureau were continued as in former years with satisfactory results.

The standard method of cost keeping was continued as usual and a general summary of results is given under a separate head. A study with a view of apportioning the distributive time of lighthouse tenders to the aids to navigation benefited was under way at the close of the fiscal year.

The Medical Handbook for use of stations and vessels was extensively revised and improved by the addition of a chapter on first-aid

methods for the injured. Reprints of this edition have been ordered by other Government services engaged in maritime work. A form, giving a list of remedies mentioned in the Medical Handbook, with directions for doses and a brief description of the therapeutic values of each, was issued during the year.

During the fiscal year the Department issued rules relative to hours of labor on Saturdays in the various district offices, standardizing the practice to be observed.

The Department also issued rules governing the granting of leave to per diem employees authorized by the act of March 3, 1915.

An Executive order was issued on October 6, 1915, upon recommendation of the Secretary of Commerce, permitting laborers in charge of lights, whose duties require only a portion of their time, to hold other appointments under State or municipal offices, subject to proper restrictions.

After careful study, a readjustment of pay of lighthouse keepers was put into effect during the year, which it is believed has created more equitable conditions, considering particularly isolated and undesirable stations.

Arrangements were made for the preparation of a corrected list of all lighthouse reservations, giving locations, areas, source of title, record of registry, consideration, existing leases, and all other pertinent information. Work on this matter was in progress at the close of the fiscal year.

The office of the lighthouse inspector of the second district, at Boston, Mass., was on December 31, 1915, moved from rented quarters to a Government-owned office in the Customhouse in Boston.

The usual lists of spare property in lighthouse districts available for transfer to other districts were issued for the information of inspectors. Special instructions were also given regarding the disposition by sale of condemned rope, cordage, and waste paper, to assist in relieving the shortage of paper material.

In accordance with a request of the Post Office Department more complete rules were prepared for shipping various small articles by mail under penalty envelopes and labels.

In view of the unusual trade conditions existing at this time and the extraordinary advance in price of many materials used in the Service, special instructions were issued governing the preparation of requisitions by inspectors, in order that contracts might be reduced so as to come within available funds.

A standard schedule of charging expenses incurred in marking wrecks or other services not directly chargeable to the Lighthouse Service was established during the year for billing to other Government services or private parties. This schedule covers depreciation of equipment, supplies, service of lighthouse tenders, and other items entering into the matter.

For the purpose of protecting the appropriations of the Lighthouse Service against loss of property loaned other branches of the Government, a regulation was approved by the Department providing for the sale of such articles by transfer of funds, with arrangements for retransfer when no longer needed, with allowance for depreciation.

Steps were taken in several lighthouse districts to overhaul and replenish libraries furnished for light stations and vessels in accordance with instructions heretofore issued on the subject.

At the conclusion of the Panama-Pacific International Exposition at San Francisco, to which reference was made in my report for 1915, arrangements were made for the transfer of portions of the Lighthouse Service exhibit to other expositions at San Diego, Cal., and Panama.

During the fiscal year small exhibits illustrating particular features of lighthouse work were shown at the annual meeting of the Chamber of Commerce of the United States, the "Safety First" exhibit at the National Museum, and an exhibit of Graphic Methods, all in Washington, D. C.

Officers of the Bureau were designated by the Secretary as delegates to the Second Pan-American Scientific Congress held in Washington and two papers on lighthouse subjects were presented by the Commissioner at regular sessions.

During the fiscal year the Department issued a pamphlet entitled "The United States Lighthouse Service, 1915," published for the purpose of furnishing general information regarding the organization and operation of the Service, and to enable the Bureau to supply data asked for in inquiries frequently received.

COST-KEEPING SYSTEM AND RESULTS.

A standard method of cost keeping has been continued in effect throughout the fiscal year, and reports have been received from all the districts, in which itemized costs of each office, depot, light and fog-signal station, tender, and light vessel are shown separately. The costs of minor lights, daymarks, and lighted and unlighted buoys are shown in groups by various districts, each type of aid to navigation being accounted for separately. In all cases the costs are divided into main headings—maintenance and betterments. The cost of maintenance includes what may be considered fixed charges, such as salaries, rations, fuel, and general expendable supplies. The item of betterments includes repairs, improvements, and new construction, and is further subdivided to show the cost of labor and materials separately for each principal object.

The costs are based on the actual expenditures during the fiscal year, whether of money or supplies. They are checked with the money accounts by taking into consideration the actual cash expenditures and the difference in the value of supplies on hand at the beginning and at the end of the year. The information from this cost-keeping system is useful in preparing estimates, planning work, effecting economies, and comparing the efficiency of different districts, vessels, light stations, apparatus, methods, etc.

A generalized summary of costs for the fiscal year ended June 30, 1916, follows, as derived from this cost-keeping system. Overhead charges, offices, depots, and tender service are stated as separate features in this summary and are not distributed nor included in the costs of aids to navigation. As elsewhere noted, a study is now being made with a view to prorating the expenses of tender service among the aids benefited. This is being accomplished by a new form of daily report for lighthouse tenders, indicating an approximate subdivision of their time devoted to the various classes of objects, from which it will be possible to proportion the expense of the vessel.

SUMMARY OF COSTS, LIGHTHOUSE SERVICE, FISCAL YEAR ENDED JUNE 30, 1916.

[Amounts are stated to nearest even dollar, causing occasional minor discrepancies in totals. Difference from total expenditures reported elsewhere is due to inclusion of Bureau salaries, printing expenses, and adjustment of inventories of articles furnished from stock.]

TOTAL COSTS OF PRINCIPAL FEATURES.

Feature.	Maintenance expenses.					Betterment expenses.				Grand total.	Per cent.
	Salaries.	Subsistence.	General supplies.	Incidental expenses.	Total.	Repairs and improvements.		New works.	Total.		
						Labor.	Materials and supplies.				
Administration <i>a</i>	\$338,422		\$52,781	\$2,596	\$393,799					\$393,799	7
Distributive charges <i>b</i>	837,840	\$199,519	433,586	30,472	1,501,462	\$108,229	\$99,292	\$271,864	\$479,385	1,980,854	34
Aids to navigation <i>c</i>	1,492,407	251,615	413,639	35,203	2,192,836	238,811	462,136	510,354	1,211,301	3,404,131	59
Total	2,668,709	451,134	900,006	68,271	4,088,097	347,040	561,428	782,219	1,690,686	5,778,784	100

TOTAL COSTS OF DETAILED FEATURES.

Offices	\$338,422		\$81,175	\$2,596	\$422,195	\$30,110	\$21,171	\$70,773	\$422,195	7
Depots	188,130		78,534	20,970	287,632				409,686	7
Tenders:										
Large	183,517	\$54,868	117,296	2,691	358,372	13,570	13,571	107,855	483,368	9
Medium	435,696	132,553	196,451	6,387	771,092	59,913	59,914	84,360	975,279	17
Small	30,537	12,098	12,911	4,424	55,970	4,636	4,636	8,876	74,119	1
Total	649,750	199,519	326,658	9,502	1,185,434	78,119	78,121	201,091	1,542,766	27
Light vessels:										
Exposed	163,681	39,547	42,286	746	246,261	16,529	16,530		279,321	5
Moderately exposed	91,969	25,244	19,098	298	136,609	18,180	18,181	63,172	236,142	4
Relief	57,271	14,832	20,396	189	92,689	12,492	12,492	64,763	182,436	3
Lakes	41,545	11,595	9,690	20,333	83,161	15,516	15,516	16,888	131,080	3
Total	354,466	91,218	91,470	21,566	558,720	62,717	62,719	144,823	828,975	15

Light stations:	First order.....	116,897	20,889	37,631	1,686	177,117	24,217	34,053	2,432	60,702	237,819	4
	Second order.....	47,840	8,506	15,228	1,175	71,747	4,518	4,732	1,635	10,885	82,632	2
	Third order.....	95,760	18,772	32,269	1,657	148,453	15,340	18,144	81,752	115,236	263,689	4
	Three and one-half order.....	22,138	4,209	5,520	20	31,886	3,061	2,315	1,025	6,401	38,287	1
	Fourth order.....	335,192	65,453	88,622	2,737	491,983	48,136	51,254	83,635	183,025	675,008	11
	Total.....	617,827	117,829	179,270	6,275	921,186	95,272	110,498	170,479	376,249	1,297,435	22
	Minor fixed aids:											
	Fifth order.....	88,067	17,949	16,978	272	123,258	7,012	7,191	898	15,100	138,358	2
	Sixth order.....	38,561	7,291	8,670	28	54,547	1,885	1,197	924	4,006	58,553	1
	Lens lanterns.....	73,981	8,374	14,589	579	97,532	7,298	11,370	10,247	28,915	126,436	2
Buoys:	Post lights.....	212,195	.....	16,439	1,219	229,553	3,099	10,870	6,293	20,262	250,113	4
	Other lights.....	101,812	8,310	37,742	2,363	150,227	18,906	63,550	144,187	228,643	376,870	7
	Daymarks, etc.....	5,497	644	3,086	1,258	10,485	2,768	5,163	15,641	23,572	34,057	1
	Total.....	520,113	42,568	97,504	5,719	665,892	40,967	99,341	178,180	318,498	984,387	17
	Lighted.....	.....	.....	31,648	489	32,137	21,140	128,235	16,862	166,237	198,374	3
	Unlighted.....	.....	.....	13,747	1,154	14,901	18,715	61,344	.....	80,059	94,960	2
	Total.....	.....	.....	45,395	1,643	47,038	39,855	189,579	16,862	246,296	293,334	5
	Grand total.....	2,668,709	451,134	900,006	68,271	4,088,097	347,040	561,428	782,218	1,660,686	5,778,784	100

^a Includes offices, except expenses of publications.
^b Includes depots and tenders; also item excepted above, charged to supplies.
^c Includes light vessels, light stations, minor fixed aids, and buoys.

SUMMARY OF COSTS, LIGHTHOUSE SERVICE, FISCAL YEAR ENDED JUNE 30, 1916—Con.

AVERAGE COSTS OF SELECTED FEATURES.

Average cost of—	Salaries.	Subsistence.	Illuminants.	Fuel.	Other supplies.	Incidentals.	Total maintenance.	Repairs and improvements.	Total.
District office, exclusive of third.....	\$12,215				\$2,013	\$124	\$14,353		\$14,353
District depot, exclusive of third.....	6,928				2,901	766	10,595	\$2,692	13,286
Large tender, Pacific.....	23,089	\$6,325		\$12,736	3,909	295	46,444	3,644	50,088
Large tender, Atlantic.....	19,041	5,982		7,900	3,282	301	36,506	2,702	39,208
Medium tender.....	13,899	4,277		4,050	2,258	205	24,689	3,550	28,539
Exposed light vessel.....	8,485	1,977	\$93	1,135	886	37	12,313	1,653	13,966
Moderately exposed light vessel.....	4,379	1,202	103	300	507	14	6,505	1,731	8,237
Lake light vessel.....	3,454	967	62	333	387	13	5,215	1,348	6,563
First-order light stations with powerful fog signals.....	2,516	437	286	427	396	56	4,118	1,698	5,814
First-order light stations without fog signals.....	1,823	232	143	97	231	20	2,646	770	3,417
Fourth-order light stations with powerful fog signal.....	1,454	287	69	231	237	19	2,297	459	2,756
Fourth-order light stations without fog signal.....	684	136	42	43	74	5	984	174	1,159
Lens lantern.....	199	23	17	6	16	2	263	a 76	339
Minor light, river districts.....	82		2		2		86	a 1	87
Minor light, other districts.....	92		5		3	1	101	a 8	109
High-pressure acetylene light.....	42	4	25	3	11	1	86	a 140	226
High-pressure acetylene buoy.....			31		b 30	1	62	a 78	c 140
Low-pressure acetylene buoy.....			74		b 6		85	a 113	c 198
Oil-gas buoy.....			33		b 22	1	56	a 28	c 84

a Figures do not include cost of establishment of new aids.

b Figures include transportation charges of all kinds, such as freight on new buoys, etc.

c Figures do not include renewal of appendages.

APPROPRIATIONS AND EXPENDITURES.

The appropriations for the maintenance of the Lighthouse Service for the fiscal year 1917 were \$5,239,030, being \$75,000 in excess of those for the preceding fiscal year. The estimates for maintenance appropriations for 1917 were divided into one appropriation for general expenses of supplies, repairs, etc., and three appropriations for salaries, with an alternative providing for all maintenance appropriations in a single item. This alternative proposition was not authorized by Congress. It is believed, however, that with this form of appropriation a more economical and efficient administration of the Lighthouse Service could be effected, and in the estimates for the next fiscal year attention has been drawn to the fact that if this consolidation is authorized a reduction of \$25,000 in the total estimates may be safely made. The appropriations for special works made for the fiscal year 1917 amounted to \$674,000, to which should be added the appropriation of \$200,000 for repairs to hurricane damages on the Gulf of Mexico, made by the act of February 28, 1916, and another appropriation of \$125,000 for similar purposes, made by the act of September 8, 1916. The average appropriations for special works for the ten preceding years, 1907 to 1916, inclusive, amounted to \$848,634.

The detailed estimates for the fiscal year 1918 are given on page 70. The total amount for general maintenance is \$239,600 more than the appropriation for the present year. Particular attention is invited to the urgent need of the Lighthouse Service for additional funds. The cost of all materials has greatly increased; salaries and wages have been uniformly advanced, and in order that the Service may be main-

EXPENDITURES FROM APPROPRIATIONS, LIGHTHOUSE SERVICE, FISCAL YEARS
1912-1916.

[Actual expenditures, regardless of year of appropriation.]

Expenditures.	1912	1913	1914	1915	1916
For maintenance.....	\$5,058,049	\$5,037,778	\$5,166,609	\$5,111,121	\$5,002,706.25
For special works.....	310,885	461,627	538,338	500,516	748,833.50
Total.....	5,368,934	5,499,405	5,704,947	5,611,637	5,751,539.75

DEPOTS.

The Lighthouse Service maintains 43 depots in the various districts for the storage and distribution of supplies and for other purposes.

The act of July 1, 1916, contained an appropriation of \$50,000 for improvements at Woods Hole Lighthouse Depot, Mass. These funds will be used for dredging the channel and basin around the wharf and for the erection of a brick storehouse to replace the present timber structure. The depot is well located for the work of the Service in the vicinity, and on completion of the proposed improvements will be very useful. The new carpenter shop at the general lighthouse depot, Tompkinsville, N. Y., is now under construction and when completed will be of benefit in avoiding the present fire hazard of the frame building now used for that purpose, as well as providing a modern, well-lighted shop for all kinds of special woodwork used by the Service.

The new lighthouse depot at Charleston, S. C., for which an appropriation was made by the act of October 22, 1913, was completed during the fiscal year so far as funds permitted, and was occupied regularly for the first time on August 1, 1916. Some of the larger articles, such as buoys, chain, and sinkers, still remained on the old dock at Castle Pinckney.

In the following districts provision should be made for improved depot facilities:

In the second district the present depot at Lovells Island, Boston Harbor, is for a number of reasons unsatisfactory, and Congress has authorized the transfer for this purpose of the old marine-hospital site at Chelsea, Boston. This property is now under lease to private parties. The question of obtaining possession of this or some other suitable site is under consideration, and an estimate is submitted for the construction of this depot. The act of August 28, 1916, subsequent to the close of the fiscal year, authorized this work at a cost not to exceed \$85,000, but no appropriation of funds was made.

In the third district estimates are submitted for improvement to the offices and laboratory at the Staten Island Depot. This project has also been authorized in the sum of \$21,000, by the act referred to above, but no appropriation was made.

In the fifth district the present principal depot at Portsmouth, Va., is inadequate both in area and in water front, considering the size of the district and the number of lighthouse vessels to be accommodated. Estimate is submitted for enlarging this depot or establishing a new one.

In the eleventh district estimates are submitted for repairs and improvements at the depot at Detroit, Mich. This work was also authorized by the act of August 28, 1916, but funds have not yet been appropriated. The authorized limit of cost is \$53,000.

The present depot at Milwaukee, Wis., is practically surrounded by coal yards and the coal dust is objectionable. Consideration is being given to obtaining a more suitable site.

In the sixteenth district, which in 1910 was organized as a separate lighthouse district, no permanent arrangement has yet been made for a depot, but temporary space is being rented at Ketchikan. A project has been submitted for consideration by Congress as resources permit, for the purchase of a site and the necessary equipment for a lighthouse depot in Alaska.

In the eighteenth district figures are submitted, for consideration as resources permit, for repairs and improvements to the Goat Island Depot, Cal.

In the nineteenth district the headquarters of the Lighthouse Service are at Honolulu, and storage facilities are either rented or granted by the courtesy of other branches of the Government. The establishment of a permanent depot in this district would facilitate the work of the service, and estimates are submitted for that purpose, as well as for making temporary provision pending the establishment of a permanent depot. The act of August 28, 1916, authorized the establishment of a temporary depot on leased land at a cost not to exceed \$5,000 and also authorized the construction of a permanent depot at a limit of \$90,000, but no funds were appropriated for either purpose.

LIGHTHOUSE TENDERS.

The tenders of the Service have been employed to good advantage during the year. The 45 vessels which have been in commission have steamed a total of about 482,000 nautical miles in their work of supplying light stations, maintaining the buoyage system, transporting construction materials, and carrying the officers and employees of the Service to their stations or on inspection duty.

Contract was awarded May 4, 1915, for the construction of the first-class seagoing lighthouse tender *Cedar*, for service in Alaska. Work on the vessel was in progress at the close of the fiscal year.

The medium-draft tender *Rose*, for service in the bays and sounds of the seventeenth lighthouse district, was launched on February 19, 1916. The vessel was completed after the close of the fiscal year and was conditionally accepted on August 8, 1916.

The small tender *Fern*, for service in the inside waters of the sixteenth lighthouse district, was completed and placed in commission on June 25, 1915, proceeding to her station of duty on July 1, 1915.

The use of oil fuel is provided for the new tenders for the Pacific coast.

A contract was awarded for the shallow-draft tender *Palmetto*, on September 27, 1915, for service in the inland waterways of the sixth lighthouse district.

An appropriation of \$20,000 was made by the act of July 1, 1916, for a light-draft tender and barge for use in establishing and maintaining aids along the intercoastal waterways of Texas and Louisiana.

With the increase in the number of aids to navigation and the deterioration of older vessels it will probably be necessary to construct on an average one or two new tenders each year.

Estimates have been submitted for three new lighthouse tenders to replace the present tenders *Gardenia*, at a cost of \$150,000, and the

John Rodgers and *Jessamine*, or for general service, as may be found most desirable, at a cost of \$180,000 each. The first of these items was authorized by the act of August 28, 1916, but no appropriation has been made for the purpose.

Radio apparatus was designed and manufactured by the Bureau of Standards for the tenders *Columbine*, *Cypress*, *Orchid*, *Manzanita*, and *Sequoia*. Installation was made on the *Columbine* and *Cypress*, but deferred on the other vessels owing to insufficiency of funds in the appropriation "Salaries, lighthouse vessels."

The condition of this appropriation also necessitated the laying up of the tender *Lilac* until such time as the shortage may be overcome.

The following tenders have either been extensively overhauled or such work has been started during the fiscal year 1916: *Larkspur*, *Ivy*, *Heather*, *Maple*, *Pansy*, *Madrono*, *Amaranth*, and *Hyacinth*. In the repair of vessels particular attention has been given to improvements which increase the comfort of the crew, and alterations with this end in view have been made on several tenders during the fiscal year.

It is probable that during the current year extensive overhaul will be completed or undertaken on the following tenders: *Mayflower*, *Mangrove*, *Crocus*, *Marigold*, *Juniper*, *Larkspur*, *Amaranth*, *Oleander*, *John Rodgers*, *Mistletoe*, *Maple*, *Jessamine*, *Ivy*, and *Magnolia*.

The following was the number of tenders of the Lighthouse Service on June 30 of the years specified, omitting vessels not having regular crews and those less than 50 feet in length: 1910, 51; 1911, 46; 1912, 45; 1913, 44; 1914, 45; 1915, 46; 1916, 47. On June 30, 1916, the following was the status of the tenders: In actual service, 38; indefinitely laid up, 1; undergoing repairs, 8.

LIGHT VESSELS.

The Lighthouse Service maintains light vessels on 53 stations and has for this purpose 66 light vessels, of which 13 are relief vessels. Some of these vessels are old, 11 having been built over 50 years ago; one is 67 years old. Some of the older vessels are in a condition which does not warrant extensive repairs.

Contracts were awarded for the construction of second-class light vessels No. 101 and No. 102 on March 6, 1915. No. 101 will be placed on station for the present at Cape Charles, Va., relieving No. 49, which is to undergo extensive repairs during the present fiscal year, and No. 102 is intended for station at Southwest Pass Entrance to Mississippi River, La. Good progress had been made by the builders up to the close of the fiscal year.

Plans and specifications have been completed and bids invited for the construction of the new third-class light vessel No. 99, and plans and specifications are in preparation for the new first-class light vessel No. 100. A contract for the construction of light vessel No. 99 was awarded on June 29, 1916.

On account of the deterioration of older vessels it will be necessary to construct one or more new light vessels each year.

Estimates have been submitted for new light vessels for general service on the Great Lakes, where they are much needed to replace vessels which must soon be withdrawn from duty, for a new light vessel for station off Cape Charles, Va., and for a light vessel for the Gulf coast, or for general service. The act of August 28, 1916, auth-

orized the vessels for the Lakes, at not to exceed \$150,000, and the vessel for Cape Charles, at \$130,000, but no appropriation was made.

The work of raising Buffalo Light Vessel No. 82, referred to in the report for 1914, was completed and the vessel successfully floated on September 17, 1915. The work of repairing and reconstructing the vessel was nearly completed at the end of the fiscal year.

Careful attention has been paid in designing and remodeling light vessels to making all parts of such vessels accessible for cleaning and painting; the use of internal-combustion engines has also been extended, which it is believed will effect an economy in maintenance.

The following light vessels have either been extensively overhauled or such work has been started during the last fiscal year: No. 6, No. 16, No. 34, No. 49, No. 60, No. 66, No. 67, No. 69, No. 70, No. 71, No. 82, No. 84, and No. 88.

It is probable that during the current fiscal year extensive overhaul will be completed or undertaken on the following light vessels: No. 1, No. 2, No. 3, No. 4, No. 13, No. 16, No. 41, No. 42, No. 43, No. 49, No. 51, No. 52, No. 55, No. 56, No. 60, No. 68, No. 70, and No. 72.

The following was the total number of light vessels and stations on June 30 of the years named:

Year.	Light vessels.	Light- vessel stations.	Year.	Light vessels.	Light- vessel stations.
1910.....	68	54	1914.....	66	52
1911.....	63	51	1915.....	66	53
1912.....	65	51	1916.....	66	53
1913.....	67	53			

Of the present light vessels 36 have self-propelling machinery and 28 are provided only with sail power. Two have no means of propulsion.

On June 30, 1916, the following was the status of the light vessels: Regular vessels on station, 45; relief vessels on station, 8; relief vessels at depots, 3; regular vessels under repair, 8; relief vessels under repair, 2; relief vessels laid up, 0.

COOPERATION.

In accordance with the established custom of the Service, every effort has been continued to consult the needs of maritime interests and to cooperate effectively with other branches of the Government in matters relating to the work of the Lighthouse Service.

By authority of the Secretary of Commerce, deck officers of light-house tenders were designated to assist in the examination under the Steamboat-Inspection Service, of applicants for certificates as life-boat men required by the recent seaman's act.

The Bureau has further cooperated with the Steamboat-Inspection Service in detailing employees for the purpose of making stability tests of a number of merchant vessels under examination by that Service.

In connection with marking fishing limits on the Middle Atlantic coast, representatives of the Lighthouse Service attended various

hearings held by United States Engineer Officers, and furnished assistance in the matter of suggestions for lighting fish pounds or the marking of fishing limits; and since then the Service has assisted the War Department in placing buoys to mark such limits as prescribed by that department.

The Lighthouse Service also placed a special buoy to mark the fishing grounds off Beaufort, N. C., for the benefit of investigational work of the Bureau of Fisheries. This Service was also able to assist the Bureau of Fisheries in causing the collection of samples of sea water for analysis at designated light stations. The plans and specifications of the Fisheries steamer *Halcyon* were prepared in cooperation with the Bureau of Fisheries, and various consulting advice was given that bureau in connection with repairs to the Fisheries steamer *Roosevelt*.

Assistance was rendered the Coast and Geodetic Survey in placing of special buoys needed for offshore surveying operations, and various special buoys were also placed for the Navy Department in connection with torpedo and gun practice by naval vessels.

The Public Health Service rendered valuable assistance to the Lighthouse Service in the preparation of the Medical Handbook and list of remedies, referred to elsewhere in this report; and also in the matter of sanitary advice, inspections, and fumigations at various stations and vessels of the Lighthouse Service.

The Bureau of Mines continued to assist the Lighthouse Service in making analyses of coal, and detailed information was furnished that bureau, at its request, in reference to coal purchased by the Lighthouse Service on contracts providing for analysis.

Arrangements were continued with the War Department for the use of lighthouse tenders for mine-planting practice, the Department of Commerce offering the service of such vessels provided they can be spared, without requesting reimbursement where the service does not exceed two days.

Joint regulations with reference to the matter of the proper authority to prescribe and supervise lights on certain structures in navigable waters during their construction period and providing for the transfer of such authority upon completion of the structures were issued by the Chief of Engineers, United States Army, and the Lighthouse Service, with the Department's approval.

Arrangements were made with the Hydrographic Office of the Navy Department for the transmission of important reports received affecting an aid to navigation, by telephone or telegraph to the proper lighthouse inspector.

The Board of Supervising Inspectors of the Steamboat-Inspection Service adopted a resolution providing that service on vessels of the Lighthouse Service shall be considered, for raise of grade, equal to similar experience obtained on merchant vessels.

In cooperation with the Department of Education of the State of Maine, provisions have been made for a traveling teacher to instruct the children of light keepers at various remote island stations in that State. The Lighthouse Service assists in the work by providing transportation for teachers, when practicable.

Observations made on various lighthouse reservations created as bird reservations under the Department of Agriculture indicate that generally successful results have attained in increasing the number of migratory birds frequenting such reserves.

Examinations and reports have been made by the Forest Service in reference to timber on various lighthouse reservations, particularly on the Great Lakes, under the authority of the act of March 3, 1915.

SAVING OF LIFE AND PROPERTY.

During the fiscal year 1916 services in saving of life and property were rendered and acts of heroism performed by employees of the Lighthouse Service on vessels or at stations on 161 occasions, a list of which is given on page 56.

In each of these cases a commendatory letter was issued by the Secretary, and in the case of the rescue of the bark *British Yeoman* by the lighthouse tender *Columbine*, Frank T. Warriner, commanding, on January 17, 1916, near Port Allen, Kauai, Hawaii, under unusually difficult and dangerous conditions, the President of the United States expressed his appreciation of the services rendered by the officers and crew of the *Columbine*.

REPORT OF OPEN-MARKET PURCHASES.

In compliance with the act of June 17, 1910, there is submitted separately as a part of this report a list of purchases of materials and supplies for the Lighthouse Service made without obtaining bids under public advertisement, with the reasons for so purchasing.

LEGISLATION ENACTED AFFECTING THE LIGHTHOUSE SERVICE.

The following is a summary of special legislation affecting the Lighthouse Service enacted at the first session of the Sixty-fourth Congress during the fiscal year 1916.

The following appropriations were made by the act of February 28, 1916: Rebuilding and repairing aids to navigation damaged or destroyed by hurricanes on the Gulf of Mexico, \$200,000; and adjudicated claim for damages for which a vessel of the Lighthouse Service was found responsible, \$53.39.

The act of July 1, 1916, made the following appropriations: Light and fog signal, Point Vincente, Cal., \$80,000; improving aids, St. Johns River, below Jacksonville, Fla., \$66,000; improvements at Woods Hole depot, Mass., \$50,000; improving aids, Fighting Island Channel, Detroit River, Mich., \$25,000; additional aids, Florida Reefs, Fla., \$75,000; improving aids, Hudson River, N. Y., \$100,000; improving aids, Mississippi River, below New Orleans, La., \$50,000; light and fog signal, Conneaut, Ohio, \$63,500; light and fog signal, near Kellett Bluff, Wash., \$40,000; improving aids, entrance to Coquille River, Oreg., \$6,000; improving aids, Toledo Harbor, Ohio, \$15,000; light at Dog Island, Me., \$3,500; improving aids, Delaware River, Pa. and Del., \$80,000; and small tender and barge, eighth district, Tex. and La., \$20,000.

The act of June 28, 1916, authorized the Secretary of Commerce to exchange the land now occupied by the Schooner Ledge Range Front Light Station at the mouth of Crum Creek, Pa., for other lands adjacent thereto, and authorized the removal of the present station after certain conditions have been complied with.

The act of June 28, 1916, authorized the sale of the former lighthouse reservation at Scituate, Mass., to the town of Scituate for maintenance as an historic landmark.

The act of August 28, 1916, subsequent to the close of the fiscal year, granted authority for the following purposes:

Exchange of rights of way of the United States in connection with lands pertaining to the Lighthouse Service for such other rights of way as may be advantageous to the Service, providing also for the payment of any expenses, not exceeding \$500, incurred by the United States in making such exchange, from the appropriation "General expenses, Lighthouse Service."

The establishment and maintenance, in the discretion of the Commissioner of Lighthouses, of post-lantern lights and other aids to navigation on the Mobile, Tombigbee, Warrior, and Black Warrior Rivers, Ala., and Lake Tahoe, Cal. and Nev.

The purchase, necessary equipment, repair, and operation of one motorcycle for the use of the Lighthouse Service in the Hawaiian Islands.

Medical relief for light keepers and assistant light keepers without charge at hospitals and stations of the Public Health Service, and providing also for certain physical examinations of persons who enter the Service hereafter.

The following works were authorized by the same act, at the limits of cost specified, but no appropriation of funds was made: Light keepers' dwellings, \$75,000; light vessels for the Great Lakes, \$150,000; lighthouse depot for second district, \$85,000; lighthouse tender for third district, \$150,000; improvements at Great Salt Pond, R. I., \$25,000; improvement of offices and laboratory, Tompkinsville, N. Y., \$21,000; improving aids, East River, N. Y., \$16,000; light vessel off Cape Charles, Va., \$130,000; improving aids leading to Cape Charles City, Va., \$12,800; improving aids, eastern shore of Chesapeake Bay, Md. and Va., \$29,000; rebuilding light station, Point Borinquen, P. R., \$85,000; improving aids, Huron Harbor, Ohio, \$4,500; improving aids, Fairport Harbor, Ohio, \$42,000; improving aids, Keweenaw Waterway Harbor of Refuge, Portage River, Mich., \$110,000; improvements at Detroit Depot, Mich., \$53,000; light and fog signal, Sand Hills, Mich., \$75,000; improvements, Manitowoc North Breakwater, Wis., \$21,000; rebuilding light station, Chicago Harbor, Ill., \$142,000; improving aids, Indiana Harbor, Ind., \$100,000; aids to navigation, Alaska, \$60,000; establishing and improving aids, Wash. and Oreg., \$35,000; temporary depot at Honolulu, Hawaii, \$5,000; lighthouse depot for nineteenth district, \$90,000; and radio equipment for lighthouse tenders, \$60,000.

The act of September 8, 1916, subsequent to the close of the fiscal year, appropriated \$125,000 for repairing and rebuilding aids to navigation on the Gulf of Mexico, which were damaged or destroyed by the hurricane of July, 1916.

SPECIAL LEGISLATION NEEDED.

The following additional legislation for the Lighthouse Service is considered desirable:

The salaries of lighthouse inspectors are, by the act of June 17, 1910, limited to \$2,400 a year, except the inspector of the third district, whose salary is fixed at \$3,600. The salary of \$2,400 is inadequate because of the heavy responsibilities with which the inspector is charged and the technical and business ability required to successfully discharge the duties. The compensation of these positions should be sufficient to bring into and retain in the Lighthouse Service

a class of persons fully competent to efficiently conduct such important work. The inspectors should be men of high character and qualifications, including technical knowledge as to engineering and nautical affairs, and should have business ability. It is recommended that the salary of inspectors, except the third, be increased to not to exceed \$3,000 a year.

It is recommended that authority be granted to make the appropriation "General expenses, Lighthouse Service" available for the payment of traveling expenses and subsistence of teachers employed by States or private persons to instruct the children of keepers of lighthouses. The Bureau has endeavored to develop plans for the proper education of keepers' children at stations not accessible to schools, and in some States has been able to obtain the cooperation of the State educational authorities. It is believed that Government assistance in the matter of providing subsistence for such teachers while at stations, would assist in promoting a worthy object at comparatively trifling expense.

It is also recommended that the limit of cost of construction of necessary outbuildings at light stations in any fiscal year, now fixed at \$200, be increased to \$500. The effect of the present limit of restriction has been to cause the erection of a number of small unsubstantial buildings at light stations, making the premises unsightly and increasing the expense of repair, which it is believed the legislation recommended would avoid.

There is great need for provision by law for the retirement of employees of the Lighthouse Service who after long service have lost their ability for active duty by reason of age or disability incident to their work. This is essential to full efficiency in the administration of the Service. In the report for 1912 a statement was given showing the practice in a number of important foreign countries with reference to the pensioning of employees in the respective lighthouse services in common with other civil employees in those countries, from which it appears that a retirement system is in force with favorable results under all of the other governments mentioned. On April 24, 1916, the Senate unanimously passed a bill providing for the optional retirement of officers and employees of the Bureau of Lighthouses and the Lighthouse Service at the age of 65 years after 30 years' service, and compulsory retirement at the age of 70 years. The retirement pay would be at the rate of one-fortieth of the last annual pay for each year of active service, not to exceed thirty-fortieths. The bill has not yet been acted upon by the House of Representatives.

This action marked the first legislative step toward a system of retirement for the Lighthouse Service which has been earnestly recommended in previous annual reports every year since 1910. The measure had the warm indorsement of the Secretary of Commerce and of the Senate Committee on Commerce, and it is hoped that Congress may see fit to enact it into law at an early date.

The statistics as to the various classes of aids to navigation and fuller details on many of the subjects mentioned in this report will be found in the pages following.

Respectfully,

GEORGE R. PUTNAM,
Commissioner of Lighthouses.

To Hon. WILLIAM C. REDFIELD,
Secretary of Commerce.

STATISTICS AND ESTIMATES.

LIST OF OFFICERS OF THE BUREAU OF LIGHTHOUSES AND THE LIGHTHOUSE DISTRICTS.

OFFICERS OF THE BUREAU OF LIGHTHOUSES ON JUNE 30, 1916.

George R. Putnam.....Commissioner of Lighthouses.
John S. Conway.....Deputy Commissioner.
H. B. Bowerman.....Chief Constructing Engineer.
Edward C. Gillette.....Superintendent of Naval Construction.

Principal Assistant Engineer, Rudolph Zirpel.
Inspector for general duty, E. M. Trott.
Chief Clerk, Thaddeus S. Clark.
Examiner, Thomas Flood.

INSPECTORS IN CHARGE OF LIGHTHOUSE DISTRICTS JULY 1, 1915, TO JUNE 30, 1916.

District.	Name.	From—	To—
1st.....	C. E. Sherman.....	July 17, 1911	
2d.....	R. H. Goddard.....	June 27, 1912	
3d.....	J. T. Yates.....	June 20, 1912	
4th.....	T. J. Rout.....	Mar. 1, 1912	
5th.....	H. D. King.....	Jan. 28, 1915	
6th.....	H. L. Beck.....	Jan. 28, 1915	
7th.....	W. W. Demeritt.....	Aug. 22, 1913	
8th.....	B. B. Dorry.....	June 6, 1912	
9th.....	C. A. Lamy.....	Aug. 7, 1912	
10th.....	Roscoe House.....	June 4, 1912	
11th.....	E. L. Woodruff.....	Aug. 19, 1912	
12th.....	L. M. Stoddard.....	Aug. 16, 1912	
13th.....	Maj. George M. Hoffman, Corps of Engineers, U. S. Army..	Oct. 16, 1913	
14th.....	Lieut. Col. H. Jervey, Corps of Engineers, U. S. Army..	Jan. 17, 1911	Aug. 9, 1915
	Col. Lansing H. Beach, Corps of Engineers, U. S. Army..	Aug. 10, 1915	
15th.....	Maj. Wildurr Willing, Corps of Engineers, U. S. Army...	July 1, 1915	
16th.....	W. C. Dillrell.....	Aug. 22, 1913	
17th.....	Robert Warrack.....	Feb. 1, 1915	
18th.....	H. W. Rhodes.....	July 6, 1912	
19th.....	A. E. Arledge.....	Sept. 3, 1912	

JURISDICTION OF LIGHTHOUSE SERVICE.

The United States Lighthouse Service is charged with the establishment and maintenance of aids to navigation and with all equipment and work incident thereto on the sea and lake coasts of the United States, on the rivers of the United States so far as specifically authorized by law, and on the coasts of all other territory under the jurisdiction of the United States, with the exception of the Philippine Islands and Panama. The total length of coast line and rivers under the United States Lighthouse Service, measured by steps of 3 miles, is approximately 47,200 miles.

LIMITS OF LIGHTHOUSE DISTRICTS.

First district.—Waters of Maine and New Hampshire.

Second district.—Waters of Massachusetts.

Third district.—Waters of Rhode Island, Connecticut, New York, and New Jersey northward of Cape May.

Fourth district.—Waters of Delaware seacoast and Delaware Bay and River.

Fifth district.—Waters of Maryland, Virginia, and North Carolina to New River Inlet, N. C.

Sixth district.—From New River Inlet, N. C., to Hillsboro Inlet, Fla.

Seventh district.—Waters of Florida from Hillsboro Inlet to Cedar Keys.

Eighth district.—Waters of Gulf coast from Cedar Keys, Fla., to mouth of Rio Grande River, Tex., and Mississippi River below New Orleans.

Ninth district.—Waters of Porto Rico and adjacent United States islands.

Tenth district.—United States waters of St. Lawrence River and Lakes Ontario and Erie.

Eleventh district.—United States waters of Lakes St. Clair, Huron, and Superior, and Detroit River.

Twelfth district.—Waters of Lake Michigan and Green Bay.

Thirteenth district.—Mississippi River above the mouth of the Missouri River, Minnesota, Illinois, Osage, Gasconade, and Missouri Rivers.

Fourteenth district.—Ohio, Tennessee, Kanawha, and Monongahela Rivers.

Fifteenth district.—Mississippi River below the Missouri River to New Orleans, La., and Red River.

Sixteenth district.—Waters of Alaska.

Seventeenth district.—Waters of Washington and Oregon.

Eighteenth district.—Waters of California.

Nineteenth district.—Waters of Hawaiian, Midway, Guam, and American Samoan Islands.

LOCATION OF DISTRICT OFFICES OF THE UNITED STATES LIGHTHOUSE SERVICE, WITH ADDRESS OF THE LIGHTHOUSE INSPECTOR.

District.	Address.	District.	Address.
1st.....	Portland, Me., Y. M. C. A. Building.	11th.....	Detroit, Mich., Post Office Building.
2d.....	Boston, Mass., Customhouse.	12th.....	Milwaukee, Wis., Federal Building.
3d.....	Tompkinsville, N. Y.	13th.....	Rock Island, Ill., Federal Building.
4th.....	Philadelphia, Pa., Post Office Building.	14th.....	Cincinnati, Ohio, Customhouse.
5th.....	Baltimore, Md., New Customhouse.	15th.....	St. Louis, Mo., Customhouse.
6th.....	Charleston, S. C., Old Post Office Building.	16th.....	Ketchikan, Alaska.
7th.....	Key West, Fla.	17th.....	Portland, Oreg., Customhouse.
8th.....	New Orleans, La., Customhouse.	18th.....	San Francisco, Cal., Customhouse.
9th.....	San Juan, P. R.	19th.....	Honolulu, Hawaii, McCandless Building.
10th.....	Buffalo, N. Y., Federal Building.		

LIGHTHOUSE DEPOTS MAINTAINED ON JUNE 30, 1916.

[The principal depot of the district is indicated by the larger type.]

District.	Location.	District.	Location.
1st.....	Bear Island, Me. LITTLE DIAMOND ISLAND, ME.	8th.....	Mobile, Ala. PORT EADS, LA.
2d.....	LOVELLS ISLAND, BOSTON, MASS. Woods Hole, Mass.	9th.....	Culebrita Island, P. R. Guantanamo Bay, Cuba.
3d.....	Goat Island, R. I. Juniper Island, Vt. New London, Conn. TOMPKINSVILLE, STATEN ISLAND, N. Y. Tucker Beach, N. J.	10th.....	SAN JUAN, P. R. BUFFALO, N. Y. Erie, Pa. Maumee Bay, Ohio. Rock Island, N. Y. Sandusky Bay (Cedar Point), Ohio.
4th.....	EDGEMOOR, DEL. Lewes, Del.	11th.....	DETROIT, MICH. Minnesota Point, Minn. St. Marys River, Mich.
5th.....	Annapolis, Md. Chincoteague, Va. Lazaretto Point, Md. Point Lookout, Md. PORTSMOUTH, VA. Washington Wharf, D. C. Washington, North Carolina.	12th.....	Charlevoix, Mich. MILWAUKEE, WIS. St. Joseph, Mich.
6th.....	CHARLESTON, S. C. ^a	16th.....	KETCHIKAN, ALASKA.
7th.....	Egmont Key, Fla. KEY WEST, FLA.	17th.....	Ediz Hook, Wash. TONGUE POINT, OREG.
8th.....	Fort San Jacinto, Galveston, Tex.	18th.....	GOAT ISLAND, CAL.
		19th.....	HONOLULU, HAWAII.

^a First occupied Aug. 1, 1916.

EXPLANATION OF TABLE ON PAGE 28.

The table of aids to navigation includes all those maintained by the Lighthouse Service, a total of 14,947. On page 45 are given facts regarding the private aids to navigation, 635 in number, maintained under authority. In the statistics, relief light vessels are not counted and duplicate or auxiliary lights and fog signals are not counted, but double lights are counted separately when maintained on distinct structures or for distinct purposes. Buoys for the purpose of marking the positions of light vessels or larger buoys are not counted. Fog signals at light stations or on vessels are counted as separate aids, but not those attached to buoys, except in the case of submarine bells, which are counted as separate signals, whether on vessels or on buoys. Otherwise each buoy is counted only once, and if it is included in a higher class it is not in the lower class. Light-vessel lights are not counted separately.

AIDS TO NAVIGATION MAINTAINED BY THE UNITED STATES LIGHTHOUSE SERVICE JUNE 30, 1916.

[See note on p. 27.]

Class.	1st dist.	2d dist.	3d dist.	4th dist.	5th dist.	6th dist.	7th dist.	8th dist.	9th dist.	10th dist.	11th dist.	12th dist.	13th dist.	14th dist.	15th dist.	16th dist.	17th dist.	18th dist.	19th dist.	Total.
LIGHTED AIDS.																				
Hyper-radiant lights.	2	5	5	2	8	8	6	3									9		1	1
First-order lights.	7	3	2			2	1	2	1		3	2						1	2	57
Second-order lights.	6	1	3	3		3	4	7	6	5	10	9				4	2	4	1	26
Third-order lights.		2	1		1	1		3	2	3	6	2								68
Three and one-half-order lights.																				21
Fourth-order lights.	35	25	58	10	49	49	4	12	2	20	44	37				4	17	21	8	348
Fifth-order lights.	18	15	18	7	22	3	1	13	2	9	16	12						2	1	139
Sixth-order lights.	1	5	21	2	8	1			4	12	5	17								76
Range-lens lights.			9	12	4	9				4	3						2			43
Reflector lights.	2	7	1	14	7	37	2	8		4	24	2					4			112
Lens-lantern lights.	12	31	53	14	48	61	44	162	13	37	91	51				88	24	36	39	804
Minor lights.	2	18	172	33	291	149	53	93	2		84	8	457	569	661	41	245	15	3	2,916
Electric lights without lens.	1	1	10		8	4		2		1	5	6				1	3	2	1	15
Light-vessel stations.	1	11																		53
Gas-lighted buoys.	6	40	50	13	54	6	4	23	4	29	76	17					10	7	5	344
Gas and whistling buoys.	6	4	11		10	8	5	6	1		1	1				1	5	8		67
Gas and aerial bell buoys.		9	17	4	18	6	6	1		3	12	17					4	3	1	101
Float lights.					2				1	10			72	38	1	8				132
Total.	99	176	431	114	530	320	130	335	38	137	380	181	529	607	662	147	334	111	62	5,323
Lights on fixed aids.	86	112	343	97	438	296	115	303	32	94	286	140	457	599	661	138	312	91	56	4,626
Lights on floating aids.	13	64	88	17	92	24	15	32	6	43	94	41	72	38	1	9	22	20	6	697
Total lighted aids.	99	176	431	114	530	320	130	335	38	137	380	181	529	607	662	147	334	111	62	5,323
UNLIGHTED AIDS.																				
Fog signals, engine power.	19	21	37	5	15	4		3		10	38	46				9	23	28		258
Fog signals, clock power.	37	14	59	7	67	3	1	13		5	5	9				1	4	9		234
Fog signals, hand power.	12	1	2								1									16
Fog signals, electric.		3	4		3					1	6	5					3	4		24
Submarine signals.	2	8	9		8	5		3								1	4	2		52
Buoys, whistling (unlighted).	20	11	6		2	6	3	8									7	18	2	83
Buoys, bell (unlighted).	53	35	57	6	26	7	5	14	4							3	9	15	1	238
Buoys, iron.	146	67	157	113	282	286	223	177	120	15	26	26				138	132	48	51	2,007
Buoys, spar (wood).	700	573	859	96	928	9		83		162	480	114	435			40	131	33	9	4,652
Daymarks, beacons, etc.	178	85	52	2	224	507	175	235	5		3	1	366	60		49	55	26	37	2,060
Total unlighted aids.	1,167	818	1,212	229	1,555	827	407	536	120	193	564	204	801	60		241	368	183	100	9,624
Grand total.	1,266	994	1,673	343	2,085	1,147	537	871	167	330	944	385	1,330	607	662	388	702	294	162	14,947

DETAILS AS TO LIGHTS ON LIGHT VESSELS.

	1st dist.	2d dist.	3d dist.	5th dist.	6th dist.	8th dist.	10th dist.	11th dist.	12th dist.	17th dist.	18th dist.	Total.
Characteristics as to lights:												
1 fixed white light.....		3	1		1			4	4			13
2 fixed white lights.....		3	3	2	1	2				2	1	14
1 fixed red light.....									1			1
2 fixed red lights.....		2										2
1 fixed white and 1 fixed red light.....		1		3	1					1		6
1 white flashing, or occulting, and 1 fixed red light.....			2									2
1 white light, flashing or occulting.....	1	1	3	2			1	1	1		1	11
1 red light, flashing or occulting.....		1										1
2 white lights, flashing or occulting.....			1	1	1							3
Illuminants:												
Incandescent oil vapor.....		1			1							2
Acetylene.....	1	1	1	1	1							5
Oil (wick).....		8	4	4	2	2		4	5	3	1	33
Oil (wick) and acetylene.....			1									1
Oil (wick) and oil gas with mantle.....			1									1
Oil gas with mantle.....				2								2
Electric arc.....			1									1
Electric incandescent.....		1	2	1			1	1	1		1	8
Illuminating apparatus:												
Fourth order.....		1			1				1			3
Reflector.....		2	3	3	1	1	1	2		1		14
Reflector and lens lantern.....		1	2									3
Lens lantern.....	1	7	5	5	2	1		3	5	2	2	33

DETAILS AS TO FOG SIGNALS.

Kind and how operated.	1st dist.	2d dist.	3d dist.	4th dist.	5th dist.	6th dist.	7th dist.	8th dist.	10th dist.	11th dist.	12th dist.	16th dist.	17th dist.	18th dist.	Total.
Steam:															
Whistle.....	9	6	6		5	2		2	4	31	32		3	7	107
Siren.....		1	1										1	1	4
Air:															
Whistle.....		5			1	1					5	1		1	14
Siren.....	2	2	22	1	4	1			5	7	9	4	7	17	81
Diaphone.....		1							1					2	3
Siren (electric).....									1	3			1	4	9
Reed horn.....	8	5	8	4	5			1				4	13		48
Submarine bells:															
On light vessels, driven by compressed air.....	1	7	7		7	3		2		3	4		3	2	39
On bottom, electric power.....										2	1				3
On buoys, operated by sea.....	1	1	2		1	2		1				1	1		10
Bell:															
Clockwork.....	37	14	59	7	67	3	1	13	5	5	9	1	4	9	234
Electric.....		4	1		3					3			1		15
Engine.....		1													1
Hand.....	12		2												14
Horn: Hand.....		1								1					2
Gun: Acetylene.....													1		1
Total.....	70	48	111	12	93	12	1	19	16	55	60	11	35	43	586

^a Auxillary fog signals (76), whistling buoys (150), and bell buoys (339) are not included.

**LIGHTED AIDS, EXCLUSIVE OF LIGHTED BUOYS, IN COMMISSION ON
JUNE 30, 1916, USING ILLUMINANTS OTHER THAN LIQUID OIL.**

INCANDESCENT OIL-VAPOR LIGHTS (308 LIGHTS).

District.	Location.	District.	Location.
1st.....	Avery Rock, Me. Baker Island, Me. Boon Island, Me. Cape Elizabeth (E), Me. Cape Elizabeth (W), Me. Cape Neddick, Me. Dice Head, Me. Egg Rock, Me. Great Duck Island, Me. Halfway Rock, Me. Isles of Shoals, N. H. Libby Islands, Me. Little River, Me. Matineus Rock North, Me. Matineus Rock South, Me. Monhegan Island, Me. Mount Desert, Me. Moose Peak, Me. Owl'shead, Me. Petit Manan, Me. Portsmouth Harbor (Newcastle), N. H. Rockland Breakwater, Me. Saddleback Ledge, Me. Seguin, Me. The Cuckolds, Me. Two-Bush Island, Me. West Quoddy Head, Me. Whaleback, Me. Whitehead, Me. Wood Island, Me.	3d (con.)...	Point Comfort, N. J. Point Judith, R. I. Race Rock, N. Y. Romer Shoal, N. Y. Sandy Hook, N. J. Seagirt, N. J. Shinnecock Bay, N. Y. Southwest Ledge, Conn. Staten Island, N. Y. Stratford Shoal (Middle Ground), N. Y. Tucker Beach, N. J. West Bank, N. Y. Watch Hill, R. I.
		4th.....	Bellevue Range Rear, Del. Brandywine Shoal, Del. Cape Henlopen, Del. Cape May, N. J. Cherry Island Range Rear, Del. Delaware Breakwater Range Front, Del. Elbow of Cross Ledge, N. J. Fenwick Island, Del. Fourteen-Foot Bank, Del. Harbor of Refuge, Del. Listons Range Front, Del. Listons Range Rear, Del. Mahon River, Del. Miah Maull Shoal, N. J. Newcastle Range Rear, Del. Reedy Island Range Front, Del. Reedy Island Range Rear, Del. Schooner Ledge Range Rear, Pa. Ship John Shoal, N. J.
2d.....	Boston, Mass. Boston Light Vessel, No. 54, Mass. Cape Ann North, Mass. Cape Ann South, Mass. Cape Cod, Mass. Cape Poge, Mass. Chatham North, Mass. Chatham South, Mass. Cuttyhunk, Mass. Dumpling Rock, Mass. Duxbury Pier, Mass. Gay Head, Mass. Long Island Head, Mass. Minots Ledge, Mass. Monomoy Point, Mass. Nantucket (Great Point), Mass. Nauset Beach, Mass. Nobska Point, Mass. Plymouth (Gurnet), Mass. Plymouth (Gurnet) Beacon, Mass. Race Point, Mass. Sankaty Head, Mass. Tarpaulin Cove, Mass. The Graves, Mass. West Chop, Mass. Wings Neck, Mass.	5th.....	Assateague, Va. Bodie Island, N. C. Cape Charles, Va. Cape Hatteras, N. C. Cape Henry, Va. Cape Lookout, N. C. Cove Point, Md. Currituck Beach, N. C. Hog Island, Va. Hooper Island, Md. Ocracoke, N. C. Point No Point, Md. Sandy Point, Md. Sharps Island, Md. Smith Point, Va. Thimble Shoal, Va. Thomas Point Shoal, Md. Wolf Trap, Va. York Spit, Va.
		6th.....	Amelia Island, Fla. Cape Canaveral, Fla. Cape Fear, N. C. Cape Romain, S. C. Charleston, S. C. Frying-Pan Shoals Light Vessel No. 94, N. C. Georgetown, S. C. Hillsboro Inlet, Fla. Hunting Island, S. C. Jupiter Inlet, Fla. Mosquito Inlet, Fla. St. Augustine, Fla. St. Johns River, Fla. St. Simon, Ga. Sapelo, Ga. Tybee, Ga.
3d.....	Absecon, N. J. Barnegat, N. J. Beavertail, R. I. Block Island North, R. I. Block Island Southeast, R. I. Chapel Hill, N. J. Conover Beacon, N. J. Eatons Neck, N. Y. Elm Tree Beacon, N. Y. Execution Rocks, N. Y. Falkner Island, Conn. Fire Island, N. Y. Great Captain Island, Conn. Hereford Inlet, N. J. Horton Point, N. Y. Little Gull Island, N. Y. Ludlam Beach, N. J. Montauk Point, N. Y. New Dorp, N. Y. New London Ledge, Conn. North Hook Beacon, N. J. Old Field Point, N. Y. Pecks Ledge, Conn. Plum Island, N. Y.	7th.....	Alligator Reef, Fla. American Shoal, Fla. Anclote Keys, Fla. Carysfort Reef, Fla. Dry Tortugas, Fla. Egmont Key, Fla. Fowey Rocks, Fla. Gasparilla Island, Fla. Sand Key, Fla. Sanibel Island, Fla. Sombrero Key, Fla.

LIGHTED AIDS, EXCLUSIVE OF LIGHTED BUOYS, IN COMMISSION ON JUNE 30, 1916,
USING ILLUMINANTS OTHER THAN LIQUID OIL—Continued.

INCANDESCENT OIL-VAPOR LIGHTS (308 LIGHTS)—Continued.

District.	Location.	District.	Location.
8th.....	Bollivar Point, Tex. Cape St. George, Fla. Cape San Blas, Fla. Matagorda, Tex. Pensacola, Fla. Point au Fer Reef, La. Sabine Bank, Tex. Sabine Pass, La. Sand Island Range Front, Ala. Ship Shoal, La. South Pass Range Rear, La. Southwest Pass Range Rear, La.	12th (con.)	North Manitou, Mich. Old Mackinac Point, Mich. Point Betsie, Mich. Pottawatomie, Wis. Poverty Island, Mich. St. Martin Island, Mich. Seul Choix Pointe, Mich. South Fox Island, Mich. South Manitou, Mich. Sturgeon Bay Canal, Wis. Tall Point, Wis. Twin River Point, Wis. White Shoal, Mich. Wind Point (Racine Point), Mich.
9th.....	Arecibo, P. R. Cape Rojo, P. R. Cape San Juan, P. R. Culebrita Island, P. R. Mona Island, P. R. Muertos Island, P. R. Point Borinquen, P. R. Point Jiguero, P. R. Point Tuna, P. R. Port San Juan, P. R.	16th.....	Cape Hinchinbrook, Alaska.
10th.....	Braddock Point, N. Y. Buffalo, N. Y. Cleveland West Breakwater Pierhead, Ohio. Dunkirk, N. Y. Fairport, Ohio.	17th.....	Alki Point, Wash. Burrows Island, Wash. Cape Arago, Oreg. Cape Blanco, Oreg. Cape Disappointment, Wash. Cape Flattery, Wash. Cape Meares, Wash. Desdemona Sands, Oreg. Destruction Island, Wash. Ediz Hook, Wash. Grays Harbor, Wash. Heceta Head, Oreg. Mukilteo, Wash. New Dungeness, Wash. North Head, Wash. Patos Islands, Wash. Point No Point, Wash. Point Wilson, Wash. Robinson Point, Wash. Semiemo Harbor, Wash. Smith Island, Wash. Tillamook Rock, Oreg. Umpqua River, Oreg. West Point, Wash. Willapa Bay, Wash. Yaquina Head, Oreg.
11th.....	An Sable, Mich. Big Bay Point, Mich. Cheboygan, Mich. Crisp Point, Mich. Detroit River, Mich. Detour, Mich. Devils Island, Wis. Duluth Range Rear, Minn. Eagle Harbor, Mich. Fort Gratiot, Mich. Forty-Mile Point, Mich. Fourteen-Mile Point, Mich. Grand Island, Mich. Granite Island, Mich. Harbor Beach Harbor of Refuge East Entrance North, Mich. Huron Island, Mich. La Pointe, Wis. Manitou, Mich. Marquette, Mich. Michigan Island, Mich. Middle Island, Mich. Outer Island, Mich. Passage Island, Mich. Point Iroquois, Mich. Pointe aux Barques, Mich. Port Austin Reef, Mich. Portage Lake Ship Canals, Mich. Presque Isle, Mich. Rock of Ages, Mich. Round Island, Mich. Spectacle Reef, Mich. Split Rock, Minn. Stannard Rock, Mich. Superior Entry South Breakwater, Wis. Tawas, Mich. Thunder Bay Island, Mich. Two Harbors, Minn. Whitefish Point, Mich.	18th.....	Ano Nuevo Island, Cal. Bonita Point, Cal. Cape Mendocino, Cal. Carquinez Strait, Cal. East Brother Island, Cal. Farallon Island, Cal. Fort Point, Cal. Goat Island, Cal. Humboldt, Cal. Los Angeles Harbor, Cal. Mile Rocks, Cal. Piedras Blancas, Cal. Pigeon Point, Cal. Point Arena, Cal. Point Arguello, Cal. Point Cabrillo, Cal. Point Conception, Cal. Point Fermin, Cal. Point Hueneme, Cal. Point Loma, Cal. Point Montara, Cal. Point Pinos, Cal. Point Reyes, Cal. Point Sur, Cal. Punta Gorda, Cal. Roe Island, Cal. St. George Reef, Cal. San Luis Obispo, Cal. Santa Barbara, Cal. Trinidad Head, Cal.
12th.....	Beaver Island, Mich. Big Sable, Mich. Calumet Harbor, Ill. Cana Island, Wis. Chicago Harbor, Ill. Grand Traverse, Mich. Grossepoint, Ill. Ile aux Galets, Mich. Little Sable, Mich.	19th.....	Barbers Point, Hawaii. Diamond Head, Hawaii. Kilauea Point, Hawaii. Makapuu Point, Hawaii. Molokai, Hawaii.

LIGHTED AIDS, EXCLUSIVE OF LIGHTED BUOYS, IN COMMISSION ON JUNE 30, 1916,
USING ILLUMINANTS OTHER THAN LIQUID OIL—Continued.

ACETYLENE LIGHTS (477 LIGHTS).

District.	Location.	District.	Location.
1st.....	Clark Point, Me. Emms Rock, Me. Fort Scammel Point, Me. House Island, Me. Portland Light Vessel No. 74, Me. Pumpkin Island Reef, Me. Steele Ledge Monument, Me. Stockton Harbor Range, Me. (2 lights).	4th (con.)..	Little River Range, Del. (2 lights). Maurice River Range, N. J. (2 lights). Mispillion River, Del. Mud Island Range, Pa. (2 lights). Raccoon Creek, N. J. (2 lights). Riverton, N. J. Salem River Range, N. J. (2 lights). Smyrna Range, Del. (2 lights). Torresdale, Pa. Tullytown, Pa.
2d.....	Bass River West Jetty, Mass. Billingsgate Island, Mass. Black Marsh Channel, Mass. Black Rocks, Mass. Canal Channel, Mass. (14 lights). Cross Rip Light Vessel No. 6, Mass. Cuttyhunk North Jetty, Mass. Deacons Pond Jetty, Mass. Gloucester Breakwater, Mass. Grassy Island Ledge, Mass. Middle Ledge, Mass. Nantucket East Breakwater, Mass. Padanaram Breakwater, Mass. Sandy Point, Mass. Upper Turn, Mass. White Rocks, Mass. Winthrop, Mass.	5th.....	Alligator River, N. C. Back River, Va. Barnes Point Shoal, Va. Battle Creek Shoal, Md. Blockade Shoal, N. C. Brewerton Channel Range Front, Md. Cutoff Channel Range, Md. (2 lights). Dividing Creek, Va. Fishing Point Outer, Va. Fort McHenry, Md. Goose Hill Channel Range Front, Va. Great Island, N. C. Guildford Flats, Va. Hack Neck Shoal, Va. Inner Middle Ground, N. C. Jarvis Point Shoal, Va. Manokin River, Md. Metomkin Point Middle Ground, Md. Oyster Creek, N. C. Petersons Point, Md. Point of Marshes, N. C. Randall Wharf, Md. Reeds Hammock, N. C. St. Pierre Island, Md. Watts Island, Va. Winter Quarter Shoal Light Vessel No. 91, Va.
3d.....	Block Island Breakwater, R. I. Block Island Breakwater Outer Basin, R. I. Branford Reef, Conn. Centerville, N. J. Cold Spring Inlet, N. J. Cooks Sedges, No. 13, N. J. Cornfield Point Light Vessel No. 48, Conn. Fuller Rock, R. I. Glencove Breakwater, N. Y. Goose Neck Point, No. 11, N. J. Great Kills, N. J. Great Salt Pond Breakwater, Outer End, R. I. Jones Rocks, Conn. Junction, N. J. Larchmont Harbor, N. Y. Little Silver, No. 9, N. J. Low Moor, No. 7, N. J. Lower Rocky Point, No. 2, N. J. Mattituck Breakwater, N. Y. Mill Rock Southerly, N. Y. Negro Point, N. Y. New London Harbor, Conn. Northeast End Light Vessel No. 44, N. J. Northwest Point, No. 2A, N. J. Pamrapo, N. J. Point Judith Harbor of Refuge, R. I. (5 lights). Saltersville, N. J. Sands Point, No. 4, N. J. Sandy Point Breakwater, Conn. Sea Haven, N. J. South Hook Beacon, N. J. U. S. Dike, Nos. 1 and 3, N. J. (2 lights).	6th.....	Bald Head, N. C. Bloody Point Range, S. C. (2 lights). Brickyard Creek, S. C. Cape Fear River, N. C. (14 lights). Charleston Light Vessel No. 34, S. C. Dawho River, S. C. (2 lights). Fort Sumter Range Front, S. C. Hilton Head Range Rear, S. C. Jones Island Range, Ga. (2 lights). New Channel Range Front, N. C. New Channel Range Front (supplemental), N. C. Paris Island Range Front, S. C. Tybee Range Front, Ga. St. Andrews Sound, Ga. Winyah Bay South Jetty, S. C. Big Marco Pass, Fla. Charlotte Harbor, Fla. Coon Key, Fla. Cut J Range, Fla. (2 lights). Eastern Triangle, Fla. East Washerwoman Shoal, Fla. Egmont Key Range Front, Fla. Key West, Fla.
4th.....	Bellevue Range Front, Del. Billingsport Range Front, N. J. Burlington Island, N. J. Chester Range Front, Pa. Cohansey, N. J. Deadman Shoal, N. J. Dennis Creek Range, Pa. (2 lights). Duck Island Range, N. J. (2 lights). Eagle Point Range, N. J. (2 lights). East Point, N. J. Egg Island, N. J. Finns Point Jetty, N. J. Grubbs Landing, Del. Horseshoe Range West Group Lower Front, Pa. Kinkora, N. J.	7th.....	Manatee River Cut A Range Front, Fla. Manatee River Cut C Range Front, Fla. Manatee River Cut D Range Front, Fla. Mangrove Point, Fla. Middle Ground, Fla. Mosquito Bank, Fla. Nine-Foot Shoal, Fla. North Bank, Fla. Northwest Bar, Fla. Northwest Passage, Fla. Peace Creek, Fla. Tortugas Harbor, Fla. Withlacoochee River, Fla.

LIGHTED AIDS, EXCLUSIVE OF LIGHTED BUOYS, IN COMMISSION ON JUNE 30, 1916,
USING ILLUMINANTS OTHER THAN LIQUID OIL—Continued.

ACETYLENE LIGHTS (477 LIGHTS)—Continued.

District.	Location.	District.	Location.
8th.....	Caucus Cut and Pensacola Bay Ranges Rear, Fla. Cutoff Channel, Ala. (2 lights). Cutoff Channel Range, Ala. (2 lights). East Bank, Tex. Galveston Bay Channel, Tex. (9 lights). Galveston Dike, West End, Tex. Galveston Jetty, Tex. Galveston North Jetty, Tex. Hitchcock Reef, Tex. Mobile Ship Channel, Ala. (20 lights). Port Arthur Canal, Tex. Port Bolivar Range, Tex. (2 lights). Sabine Pass Channel, La. Sabine Pass Entrance and Inner Ranges, La. (4 lights). Sand Island Range Rear (twin), Ala. (2 lights). Seabrook, Tex. Second Turn, Tex. Southwest Pass East Jetty, La. Texas City Channel, Tex. (6 lights).	12th.....	Bank Point, Mich. Chicago Breakwater North, Ill. Chicago Breakwater South, Ill. Elbow, Wis. Frankfort South Pierhead, Mich. Grand Haven North Pierhead, Mich. Holland Range Front, Mich. Indiana Harbor Range, Ind. (2 lights). Kenosha Breakwater, Wis. Kewaunee North Pierhead, Wis. Ludington North Breakwater, Mich. Ludington South Breakwater, Mich. Manistee South Breakwater, Mich. Manistique West Breakwater, Mich. Manitowoc South Breakwater, Wis. Michigan City Breakwater, Ind. Milwaukee Breakwater, Wis. Milwaukee South Pierhead, Wis. Muskegon North Pierhead, Mich. Oconto Harbor South Pierhead, Wis. Petoskey, Mich. Racine Pierhead, Wis.
9th.....	Anegado Shoal Range, P. R. (2 lights). Catano Range, P. R. (2 lights). Mayaguez Harbor Range, P. R. (2 lights).		Saugatuck North Pierhead, Mich. Saugatuck South Pierhead, Mich. Saunders Point, Mich. Sheboygan Breakwater, Wis. Sheboygan South Pierhead, Wis. Squaw Point, Mich. Waukegan Breakwater, Wis.
10th.....	Ponce Range Front, P. R. Ashtabula East Breakwater, Ohio. Ashtabula West Breakwater Pierhead, Ohio. Ballast Island, Ohio. Carleton Island, N. Y. Chaumont Harbor, N. Y. Cherry Island, N. Y. Cleveland East Pierhead, Ohio. Cleveland East Breakwater, Ohio. Cleveland East Pier, Ohio. Cleveland West Breakwater, Ohio. Cleveland West Pier, Ohio. Conneaut West Breakwater, Ohio. Fairport West Pierhead, Ohio. Fairport West Pier, Ohio. Horseshoe Reef, N. Y. Linda Island, N. Y. Lorain East Breakwater Pierhead, Ohio. Lorain West Breakwater Pierhead, Ohio. Monroe, Mich. Niagara River Range, N. Y. (2 lights). South Buffalo Pierhead, N. Y. Strawberry Island Lower Cut Range, N. Y. (2 lights). Strawberry Island Upper Cut Range, N. Y. (2 lights). Wells Island, N. Y.	13th.....	Ballinger Float, Iowa. Fort Madison Float, Iowa. Waggoner Point, Iowa.
		16th.....	Anchor Point, Alaska. Barlow Islands, Alaska. Barren Island, Alaska. Battery Point, Alaska. Beaulerc Island, Alaska. Blank Island, Alaska. Busby Island, Alaska. Bushy Island, Alaska. Caines Head, Alaska. Cape Chacon, Alaska. Cape Fanshaw, Alaska. Cape St. Elias, Alaska. Cape Spencer, Alaska. Cape Stephens, Alaska. Cape Strait, Alaska. Channel Island, Tongass Narrows, Alaska. Channel Island, Orca Bay, Alaska. Clear Point, Alaska. Dewey Rocks, Alaska. East Chugach, Alaska. East Clump, Alaska. East Foreland, Alaska. Elrington Passage, Alaska. Eye-Opener, Alaska. Fairway Island, Alaska. Flat Island, Alaska. Grave Point, Alaska. Gray Cliff, Alaska. Guard Islands, Alaska. Hawk Inlet East Shoal, Alaska. Hawk Inlet Entrance, Alaska. Hog Rocks, Alaska. Johnstone Point, Alaska. Key Reef, Alaska. Kingsmill Point, Alaska. Lewis Reef, Alaska. Lincoln Rock, Alaska. Little Island, Alaska. Lone Tree Point, Alaska. Lord Rocks, Alaska. Low Point, Alaska. Marmion Island, Alaska. McClellan Rock, Alaska. Mellen Rock, Alaska. Middle Point, Alaska.
11th.....	Au Sable Pierhead, Mich. Charity Island, Mich. Grand Island Harbor Range, Mich. (2 lights). Gull Rock, Mich. Harbor Beach Harbor of Refuge East Entrance South, Mich. Isle Royal, Mich. Livingstone Channel, Mich. (9 lights). Peach Island Range, Mich. (2 lights). Pilgrim Point, Mich. Portage River Pierhead, Mich. Port Wing East Breakwater, Mich. St. Clair Flats Range, Mich. (2 lights). Sturgeon Point, Mich. Superior Harbor Basin No. 1, Wis. Superior Entry Inner North Breakwater, Wis. Superior Entry North Breakwater, Wis. Superior Entry Inner South Pierhead, Mich.		

LIGHTED AIDS, EXCLUSIVE OF LIGHTED BUOYS, IN COMMISSION ON JUNE 30, 1916,
USING ILLUMINANTS OTHER THAN LIQUID OIL—Continued.

ACETYLENE LIGHTS (477 LIGHTS)—Continued.

District.	Location.	District.	Location.
16th (con.).	Middle Rock, Alaska. Midway Islands, Alaska. Midway Rock, Alaska. Mitkof Island, Alaska. Moirs Rock, Alaska. Naked Island, Alaska. Narrow Point, Alaska. Ocean Cape, Alaska. Otstola Island, Alaska. Petersburg Float, 24, Alaska. Pilot Rock, Alaska. Point Alexander, Alaska. Point Arden, Alaska. Point Augusta, Alaska. Point Ellis, Alaska. Point Elrington, Alaska. Point Gambier, Alaska. Point Gardner, Alaska. Point Helen, Alaska. Point Hugh, Alaska. Point McCartney, Alaska. Point Retreat, Alaska. Point Romanoff, Alaska. Point St. Albans, Alaska. Point Sherman, Alaska. Race Point, Alaska. Rocky Island, Alaska. Rosa Reef, Alaska. Rugged Island, Alaska. Seal Island, Alaska. Seal Rocks, Alaska. Shakan Bay, Alaska. Sheep Creek, Alaska. Shelter Island, Alaska. Ship Island, Alaska. Smith Island, Alaska. Spanish Islands, Alaska. Spire Island Reef, Alaska. Stikine Strait, Alaska. Strait Island, Alaska. Sukoi Islets, Alaska. Tenakee Inlet, Alaska. Turnabout Island, Alaska. Vank Island, Alaska.	16th (con.).	Vichnefski Rock, Alaska. Warburton Island, Alaska. Whale Island, Alaska. Windy Bay, Alaska. Woody Island, Alaska. 17th.....
			Beacon No. 2, Oreg. Browns Point, Wash. Columbia River Entrance Range, Oreg., Wash. (2 lights). Iceberg Point, Wash. Lime Kiln, Wash. Lower Sands, Oreg. Marrowstone Point, Wash. Neah Bay, Wash. Peapod Rocks, Wash. Turn Rock, Wash. Viti Rocks, Wash. Waterman Point, Wash. 18th.....
			Anacapa Island, Cal. Ballast Point, Cal. La Playa, Cal. Light No. 5, San Diego Bay, Cal. Redding Rock, Cal. Richardson Rock, Cal. San Diego Entrance Range, Cal. (2 lights). South San Francisco, Cal. 19th.....
			Cocoanut Point, Hawaii. Hanapepe, Hawaii. Hawea Point, Hawaii. Kahala Point, Hawaii. Kahului Breakwater, Hawaii. Kauiki Head, Hawaii. Kaunakakai Range, Hawaii (2 lights). Kawaihae, Hawaii. Keahole Point, Hawaii. Kukuihaele, Hawaii. Laau Point, Hawaii. Lao Kokole, Hawaii. Laupahoe, Hawaii. McGregor Point, Hawaii. Mahukona, Hawaii. Molokini, Hawaii. Pauwahu Point, Hawaii.

ELECTRIC ARC LIGHTS (5 LIGHTS).

3d.....	Ambrose Channel Light Vessel No. 87, N. Y. Navesink, N. J.	17th.....	Astoria Range, Oreg. (2 lights; no lens).
		18th.....	Alcatraz Island, Cal.

ELECTRIC INCANDESCENT LIGHTS (73 LIGHTS).

1st.....	Kennebunkport Pier, Me. (no lens).	5th (con.)..	Diamond Shoal Light Vessel No. 71, N. C.
2d.....	Canal Breakwater, Mass. Gallups Island, Mass. Great Harbor Range, Mass. (2 lights). Nantucket Shoals Light Vessel No. 85, Mass. Windmill Point, Mass.		Lazaretto Point, Md. North Jetty, Va.
3d.....	Aunt Phebe Rock, N. Y. Fire Island Light Vessel, N. Y. Goat Island Shoal, R. I. Newport Wharf, Vt. Overfalls Light Vessel No. 69, Del.	7th.....	Key West Main Ship Channel Range, Fla. (2 lights).
4th.....	Cherry Island Range Front, Del. Deepwater Point Range Rear, N. J. Schuylkill River Range, Pa. (2 lights).	9th.....	Ponce Harbor Range Rear, P. R. Puntilla Point, P. R. Puntilla Shoal, P. R.
5th.....	Cape Charles City Harbor Northern, Va. Cherrystone Channel Inlet Range Rear, Va.	10th.....	Buffalo South Pier, N. Y. Cleveland East Entrance, Ohio.
		11th.....	Alpena, Mich. Ashland Breakwater, Wis. Atlantic Point, Mich. Center Pierhead, Mich. Cole Creek, Mich. Duluth Range Front, Mich. Fort Gratiot Range, Mich. (2 lights). Marquette Breakwater, Mich.

LIGHTS ESTABLISHED DURING THE FISCAL YEAR 1916—Continued.

District.	Location.	Order.
6th.....	Fort Sumter Range Front, S. C.....	Range lens (acetylene).
	Fort Sumter Range Rear, S. C.....	Reflector.
	Jekyll Island Range Front, Ga.....	Minor.
	Jenkins Island Flat, S. C.....	Do.
	Skull Creek, S. C. (4 lights).....	Do.
	Turtle River Lower Range Front, Ga.....	Do.
7th.....	Coon Key, Fla.....	Minor (acetylene).
	Dredged Cut Entrance, Fla.....	Minor.
	Fisheating Creek, Fla.....	Do.
	Grass Islands, Fla.....	Do.
	Hillsborough Canal, Fla.....	Do.
	Kissimmee River, Fla.....	Do.
	Lake Hicpochee, Fla. (2 lights).....	Do.
	Manatee River Cut D Range Front, Fla.....	Minor (acetylene).
	Manatee River Cut D Range Rear, Fla.....	Lens lantern.
	Manatee River Cut C Range Front, Fla.....	Minor (acetylene).
	Manatee River Cuts A and C Ranges Rear.....	Lens lantern.
	Manatee River Cut A Range Front, Fla.....	Minor (acetylene).
	New River Canal, Fla. (2 lights).....	Minor.
	Miami Canal, Fla.....	Do.
	Observation Shoal North End, Fla.....	Do.
	Palm Beach Canal, Fla.....	Do.
	Pelican Point, Fla.....	Do.
	Rita Island, Fla.....	Do.
	Rock Reef, Fla.....	Do.
	St. Lucie Canal, Fla.....	Do.
	Taylor Creek, Fla.....	Do.
	Three-Mile Canal, Fla.....	Do.
8th.....	Atchafalaya Channel, La. (5 lights).....	Lens lanterns.
	Calcasieu-Sabine East, La.....	Minor.
	Calcasieu-Sabine West, La.....	Do.
	Neches River, Tex. (5 lights).....	Do.
	Point au Fer Reef, La.....	Fourth (incandescent oil vapor).
	Sabine-Neches Canal, Tex. (6 lights).....	Minor.
	Sabine River, Tex.....	Do.
	Texas City Channel, Tex. (6 lights).....	Range lenses (acetylene).
9th.....	Punta Larga Shoal Light Buoy, P. R.....	Minor.
	Puntilla Shoal, P. R.....	Minor (electric).
10th.....	Ballast Point, Ohio.....	Lens lantern (acetylene).
	Linda Island, N. Y.....	Do.
11th.....	Keweenaw Harbor of Refuge, Mich.....	Lens lantern.
	Livingstone Channel, No. 9, Mich.....	Lens lantern (acetylene).
	St. Clair Flats Range, Mich. (2 lights).....	Minor (acetylene).
	St. Louis River, No. 1, Minn.....	Minor.
	South Channel, No. 9, Minn.....	Do.
12th.....	Manistee South Breakwater, Mich.....	Lens lantern (acetylene).
	Menominee Pierhead Range Rear, Mich.....	Lens lantern.
	Sheboygan South Pierhead, Wis.....	Lens lantern (acetylene).
	South Haven Range Rear, Mich.....	Lens lantern.
13th.....	18 lights.....	Minor.
	8 lighted spar buoys.....	Do.
14th.....	5 lights.....	Do.
	1 float light.....	Do.
15th.....	65 lights.....	Do.
16th.....	Akutan Harbor, Alaska.....	Do.
	Anchor Point, Alaska.....	Lens lantern (acetylene).
	Barlow Islands, Alaska.....	Do.
	Barren Island, Alaska.....	Do.
	Beck Island, Alaska.....	Minor.
	Blunt Point Reef Float, 22, Alaska.....	Do.
	Burnt Island Reef Float, 2, Alaska.....	Do.
	Clear Point, Alaska.....	Minor (acetylene).
	East Chugach, Alaska.....	Lens lantern (acetylene).
	East Foreland, Alaska.....	Do.
	Flat Island, Alaska.....	Do.
	Hawk Inlet East Shoal, Alaska.....	Minor (acetylene).
	Hawk Inlet Entrance, Alaska.....	Do.
	Kingsmill Point, Alaska.....	Lens lantern (acetylene).
	Lewis Reef, Alaska.....	Minor (acetylene).
	Little Island, Alaska.....	Lens lantern (acetylene).
	Low Point, Alaska.....	Do.
	Marmion Island, Alaska.....	Do.
	McClellan Rock, Alaska.....	Do.
	Middle Point, Alaska.....	Do.
	Moirs Rock, Alaska.....	Do.
	Naked Island, Alaska.....	Do.
	Narrow Point, Alaska.....	Do.
	Otstolia Island, Alaska.....	Do.
	Point Alexander, Alaska.....	Do.
	Point Augusta, Alaska.....	Do.
	Point Gambier, Alaska.....	Do.

LIGHTS ESTABLISHED DURING THE FISCAL YEAR 1916—Continued.

District.	Location.	Order.
16th (con.).	Point McCartey, Alaska.....	Lens lantern (acetylene).
	Point St. Albans, Alaska.....	Do.
	Popof Reef Float, 1, Alaska.....	Minor.
	Race Point, Alaska.....	Lens lantern (acetylene).
	Rosa Reef, Alaska.....	Minor (acetylene).
	Rose Inlet, Alaska.....	Minor.
	Seal Rocks, Alaska.....	Lens lantern (acetylene).
	Sheep Creek, Alaska.....	Minor (acetylene).
	Tenakee, Alaska.....	Lens lantern.
17th.....	Burke, Wash.....	Minor.
	Candiana, Wash.....	Do.
	Fashion Reef, Wash.....	Do.
	Hayden, Oreg.....	Do.
	Iceberg Point, Wash.....	Lens lantern (acetylene).
	Johnson, Wash.....	Minor.
	Main Channel Range, Wash. (2 lights).....	Reflector (electric).
	Multnomah Channel, Oreg.....	Minor.
	Oak Bay, Wash.....	Do.
	Port Townsend Canal Range, Wash. (2 lights).....	Do.
	Snag Island Jetty, Wash.....	Do.
	Tunnel Point, Wash.....	Do.
	Washougal Upper, Oreg.....	Do.
	Waterman Point, Wash.....	Minor (acetylene).
	Willamette Falls, Oreg.....	Minor (electric).
18th.....	Redwood Creek Entrance, Cal.....	Minor.
19th.....	Kuhio Bay Range, Hawaii (2 lights).....	Lens lantern (electric).

LIGHTS WHERE ILLUMINATION WAS IMPROVED DURING THE FISCAL YEAR 1916.

FLASHING OR OCCULTING LIGHTS CHANGED FROM FIXED LIGHTS (49 LIGHTS).

District.	Location.	District.	Location.
2d.....	Cross Rip Light Vessel No. 6, Mass.	9th.....	Catano Range Front, P. R.
	Gloucester Breakwater, Mass.		Ponce Harbor Range Front, P. R.
3d.....	Fire Island Light Vessel No. 68, N. Y.	10th.....	Monroe, Mich.
	Larchmont Harbor, N. Y.	11th.....	Ashland Breakwater, Wis.
4th.....	Burlington Island, N. J.		Charity Island, Mich.
	Chester Range Front, Pa.		Portage River Pierhead, Mich.
	Deepwater Point Range Rear, N. J.	12th.....	Elbow, Wis.
	Dennis Creek Range, N. J. (2 lights).		Holland (Black Lake) Range Front, Mich.
	Duck Island Range, N. J. (2 lights).		Ludington South Breakwater, Mich.
	Kinkora, N. J.		Milwaukee Light Vessel No. 95, Wis.
	Little River Range, Del. (2 lights).		Saugatuck South Pierhead, Mich.
	Riverton, N. J.	13th.....	Ballinger Float, Iowa.
	Torresdale, Pa.		Fort Madison Float, Iowa.
	Tullytown, Pa.		Waggoner Point, Iowa.
5th.....	Barnes Point Shoal, Va.	16th.....	Gray Cliff, Alaska.
	Blockade Shoal, N. C.		Point Romanoff, Alaska.
	Goose Hill Channel Range Front, Va.	17th.....	Beacon No. 2, Oreg.
	Metomkin Point Middle Ground, Md.		Browns Point, Wash.
	Point of Marshes, N. C.		Robinson Point, Wash.
	Randall Wharf, Md.	18th.....	Oakland Harbor, Cal.
6th.....	Charleston Light Vessel No. 34, S. C.		South San Francisco, Cal.
7th.....	Big Marco Pass, Fla.	19th.....	Cocoanut Point, Hawaii.
8th.....	Galveston North Jetty, Tex.		
9th.....	Anegado Shoal Range Front, P. R.		

INCANDESCENT OIL-VAPOR LIGHTS CHANGED FROM OIL-WICK LIGHTS (19 LIGHTS).

1st.....	Cape Elizabeth, Me. (2 lights).	12th.....	Little Sable, Mich.
	Little River, Me.		North Manitou, Mich.
2d.....	Wings Neck, Mass.		Pottawatomie, Wis.
3d.....	Southwest Ledge, Conn.		Poverty Island, Mich.
4th.....	Cherry Island Range Rear, Del.		Seul Choix Pointe, Mich.
11th.....	Fourteen Mile Point, Mich.		South Fox Island, Mich.
	Grand Island, Mich.		St. Martin Island, Mich.
12th.....	Beaver Island, Mich.		Wind Point, Wis.
	Ile aux Galets, Mich.	17th.....	Robinson Point, Wash.

LIGHTS WHERE ILLUMINATION WAS IMPROVED DURING THE FISCAL YEAR, 1916—
Continued.

ACETYLENE OR OTHER LIGHTS CHANGED FROM OIL-WICK LIGHTS, ETC. (57 LIGHTS)

District.	Location.	District.	Location.
2d.....	Cross Rip Light Vessel No. 6, Mass.	9th.....	Anegado Shoal Range, P. R. (2 lights).
	Gloucester Breakwater, Mass.		Catano Range, P. R. (2 lights).
3d.....	Winthrop Point, Mass. (electric).		Mayaguez Harbor Range, P. R. (2 lights).
	Larchmont Harbor, N. Y.		Ponce Harbor Range Front, P. R.
	Newport Wharf, Vt. (electric).		Ponce Harbor Range Rear, P. R.
4th.....	Burlington Island, N. J.		(electric).
	Cherry Island Range Rear, Del.	10th.....	Cleveland East Entrance, Ohio,
	(electric).		(electric from acetylene).
	Chester Range Front, Pa.		Monroe, Mich.
	Deepwater Point Range Rear, N. J.	11th.....	Ashland Breakwater, Wis. (electric).
	(electric).		Charity Island, Mich.
	Dennis Creek Range, N. J. (2 lights).		Duluth Range Front, Mich. (electric).
	Duck Island Range, N. J. (2 lights).		Pilgrim Point, Mich.
	Kinkora, N. J.		Saginaw River Range, Mich. (2 lights,
	Little River Range, Del. (2 lights).		electric).
	Riverton, N. J.		Two Harbors Breakwater, Minn. (oil-
	Torresdale, Pa.		gas to electric).
	Tullytown, Pa.	13th.....	Ballinger Float, Iowa.
5th.....	Back River, Va.		Fort Madison Float, Iowa.
	Barnes Point Shoal, Va.		Waggoner Point, Iowa.
	Blockade Shoal, N. C.	16th.....	Gray Cliff, Alaska.
	Cape Charles City Harbor Northern,		Point Romanoff, Alaska.
	Va. (electric).	17th.....	Beacon No. 2, Oreg.
	Goose Hill Channel Range Front, Va.		Browns Point, Wash.
	Metomkin Point Middle Ground, Md.	18th.....	Oakland Harbor, Cal. (electric).
	Point of Marshes, N. C.		South San Francisco, Cal.
	Randall Wharf, Md.	19th.....	Cocoanut Point, Hawaii (from
	Watts Island, Va.		electric).
6th.....	Charleston Light Vessel No. 34, S. C.		
7th.....	Big Marco Pass, Fla.		

LIGHTS DISCONTINUED DURING THE FISCAL YEAR 1916.

[120 lights, including float lights.]

District.	Location.	Order.
3d.....	Brockway West Channel Range, Conn. (2 lights).....	Minor.
	Rondout, N. Y.....	Lens lantern.
	Rondout North Dike End, N. Y.....	Do.
4th.....	Eddington, Pa.....	Minor.
5th.....	Shackleford Point Range, N. C. (2 lights).....	Lens lanterns.
6th.....	St. Philip's Church, S. C.....	Reflector (gas.)
7th.....	Manatee River Cut, Fla.....	Lens lantern.
	Snead Point Shoal, Fla.....	Do.
8th.....	Southwest Reef, La.....	Fourth.
	Texas City Channel, Nos. 1, 1A, 3A, 5, Tex. (4 lights).....	Lens lanterns (acetylene).
10th.....	Ashtabula West Breakwater, Ohio.....	Fourth.
12th.....	Sheboygan Pierhead, Wis.....	Fifth.
13th.....	26 lights.....	Minor.
	2 lighted spar buoys.....	Do.
14th.....	4 lights.....	Do.
15th.....	67 lights.....	Do.
16th.....	Point Young, Alaska.....	Lens lantern (acetylene).
17th.....	Prendle Landing, Wash.....	Minor.
19th.....	Lahaina, Hawaii.....	Do.
	Guam.....	Do.

**LIGHTS, EXCLUSIVE OF LIGHTED BUOYS, WHICH WILL PROBABLY BE
ESTABLISHED DURING THE FISCAL YEAR 1917.**

District.	Location.	Probable date of establishment.	Order.	Illuminant.	Additional keepers or laborers required.
1st.....	Dog Island, Mo.....			Acetylene.....	0
2d.....	Mystic River, Mass.....	Sept., 1917	Lens lantern..	do.....	0
3d.....	Sayville, N. Y.....	Dec., 1916	do.....	Electric incandescent.	0
	Tuckerton, N. J.....	Aug., 1916	Lens lantern (2).	Oil wick.....	1
4th.....	Biles Island, N. J.....		Post lantern (2).	Acetylene.....	0
	Broadkill Jetty, Del.....		Post lantern..	do.....	0
	Chester Range, Del.....	June, 1917	Reflector.....	do.....	0
			Fourth order..	Incandescent oil vapor.	1
	Marcus Hook Range, Del.....	June, 1917	Reflector.....	Acetylene.....	0
			Fourth order..	Incandescent oil vapor.	1
	Oldmans Creek, N. J.....		Post lantern (2).	Acetylene.....	0
	Penn Manor, Pa.....		do.....	do.....	0
5th.....	Curtis Bay, Md.....	Oct., 1916	Minor.....	Oil.....	1
6th.....	Steamboat Creek, S. C.....	Nov., 1916	do.....	Acetylene.....	0
	Fenwick Island Cut, S. C.....	do.....	do.....	do.....	0
	Marsh Island Spit, S. C.....	do.....	do.....	do.....	0
	Bull Spit, S. C.....	do.....	do.....	do.....	0
7th.....	Charlotte Harbor Entrance, Fla.....	Mar., 1917	Lens lantern (3).	do.....	0
			Reflector.....	Oil.....	0
	Cuts B and D, Tampa Bay, Fla.....	June, 1917	Lens lantern (4).	Acetylene.....	0
	Cut G, Tampa Bay, Fla.....	July, 1916	Lens lantern (2).	Oil.....	0
	Cut K, Tampa Bay, Fla.....	do.....	do.....	do.....	0
			Reflector.....	do.....	0
	Cut H, Range Rear, Caloosahatchee River, Fla.....	Feb., 1917	Lens lantern..	do.....	0
	Hawk Channel, Fla.....	Mar., 1917	Lens lantern (6).	Acetylene.....	0
	Hillsboro Bay, Fla.....	Aug., 1916	Lens lantern (2).	Oil.....	0
	Hillsboro River, Fla.....	do.....	do.....	do.....	0
	Key West Harbor and Entrance, Fla.....	Apr., 1917	Lens lantern (5).	Acetylene.....	0
			do.....	Oil.....	0
	Miami Harbor and Entrance, Fla.....	Dec., 1916	Lens lantern (15).	do.....	0
	Sarasota Bay, Fla.....	June, 1917	Minor.....	do.....	1
	Sea Horse Reef, Fla.....	Feb., 1917	Lens lantern..	Acetylene.....	0
	South Bar, Cedar Keys, Fla.....	Jan., 1917	do.....	do.....	0
8th.....	Bastian Bay, La.....	Nov., 1916	Minor.....	Oil.....	1
	Bayou Cook, Bastian Bay, La.....	do.....	do.....	do.....	1
	Bayou Courant, Bay Adam, La.....	do.....	do.....	do.....	1
	Trinity River, Tex.....	Sept., 1916	do.....	do.....	0
	Galveston Jetty, Tex.....	Nov., 1916	Third order..	Incandescent oil vapor.	3
9th.....	Cucaracha, P. R.....	Sept., 1916	Sixth order...	Oil gas.....	0
	Paya Cuaba, P. R.....	Jan., 1917	Minor.....	Acetylene or oil gas.	0
	Fajardo Roads, P. R.....	do.....	Minor (2)....	Electric incandescent.	1
	Guayanilla, P. R.....	June, 1917	do.....	Oil gas.....	0
	Navassa Island.....	Jan., 1917	Fourth order..	Incandescent oil vapor.	3
	Parse Shoal, P. R.....	June, 1917	Minor.....	Oil gas.....	0
10th.....	Grand Island, N. Y.....	do.....	Lens lantern (2).	Acetylene.....	0
	Lorain East Pier, Ohio.....	do.....	Lens lantern..	do.....	0
	Lorain West Breakwater Pierhead, Ohio.....	do.....	Fourth order..	Incandescent oil vapor.	2
11th.....	Fighting Island Channel, Detroit River, Mich.....	do.....	Reflector (2) ..	Electric incandescent.	0
			Lens lantern (2).	Acetylene.....	0
	Mackinac Breakwater, Mich.....	June, 1917	Lens lantern..	do.....	0
	Two Harbors West Breakwater, Mich.....	Aug., 1916	do.....	do.....	0

**LIGHTS, EXCLUSIVE OF LIGHTED BUOYS, WHICH WILL PROBABLY BE ESTABLISHED
DURING THE FISCAL YEAR 1917—Continued.**

District.	Location.	Probable date of establishment.	Order.	Illuminant.	Additional keepers or laborers required.
12th.....	Pentwater Pierhead, Mich.....	May, 1917	Minor.....	Acetylene.....	0
	Portage Lake Pierhead, Mich.....	May, 1917	Lens lantern..	do.....	0
	Racine South Breakwater, Wis.....	June, 1917	do.....	do.....	0
	Racine North Pierhead, Wis.....	do.....	do.....	do.....	0
16th.....	Black Rock, Alaska.....	May, 1917	do.....	Oil.....	0
	Cape St. Elias, Alaska.....	Sept., 1916	Third order..	Incandescent oil vapor.	4
	Hanin Rocks, Alaska.....	July, 1916	Lens lantern..	Acetylene.....	0
	Katalla, Alaska.....	Aug., 1916	Minor.....	Oil.....	1
	Spike Rock, Alaska.....	Sept., 1916	do.....	do.....	0
	Susitna River Entrance, Alaska.....	June, 1917	Lens lantern..	Acetylene.....	0
	Turn Point Shoal, Alaska.....	Dec., 1916	Minor.....	Oil.....	0
17th.....	Apple Cove Point, Wash.....	Oct., 1916	do.....	Acetylene.....	0
	Cape Horn, Oreg.....	Sept., 1916	do.....	do.....	1
	Coal Bank, Oreg.....	Oct., 1916	do.....	Electric incandescent.	1
	Grays Bay, Wash.....	July, 1916	do.....	Oil.....	1
	Hamblock, Oreg.....	Sept., 1916	do.....	do.....	1
	Kellett Bluff, Wash.....	June, 1917	Fourth order..	Incandescent oil vapor.	2
	Slaughters, Oreg.....	Sept., 1916	Minor.....	Acetylene.....	0
	Slaughters Bar, Oreg.....	do.....	Minor (6).....	Oil.....	0
18th.....	Point Vincente, Cal.....	May, 1917	Third order..	Incandescent oil vapor.	3
19th.....	Hanamanioa Point, Hawaii.....	June, 1917	Lens lantern..	Acetylene.....	0
	Kipahulu, Hawaii.....	Jan., 1917	do.....	do.....	0
	Kukii Point, Hawaii.....	Aug., 1916	do.....	do.....	0

**GAS BUOYS ESTABLISHED AND DISCONTINUED DURING THE FISCAL
YEAR 1916.**

District.	Location.	District.	Location.
	ESTABLISHED (89).		ESTABLISHED (89)—continued.
1st.....	Catfish Rock, Me.	5th (con.)..	Elizabeth River, 2 (bell), Va.
	25-Foot Ledge, 3, Me.		Emma F. Angell Wreck, Va.
2d.....	Bombay Wreck, Mass.		Fort McHenry Channel, 4M (bell), Md.
	Buzzards Bay (bell), Mass.		Fort McHenry Channel, 20M, Md.
	Canal Approach (bell), Mass.		Katahdin Wreck, Va.
	Canal Breakwater (bell), Mass.		Lynn Haven Roads, 3, Va.
	Canal Channel, 4 (bell), Mass.		Naval Target Wreck, Va.
	Cleveland Ledge, 7 (bell), Mass.		N. H. Burrow Wreck, Va.
	Lackawana Wreck (bell), Mass.		Poplar Island, 20A (bell), Va.
	Negro Ledge, 5 (bell), Mass.		Shamokin Wreck, Va.
	No Mans Land, 2 (whistle), Mass.		Stone Barge Wreck, Va.
	Yankee Wreck (bell), Mass.		Sunken Raft Wreck, Md.
3d.....	Abbie Wreck, N. Y.		Tangier Island Shoal Lump, 12TL (bell), Va.
	Alex. Gibson Wreck, N. J.		Willoughby Bank, 17, Va.
	Barge Wreck, N. Y.	6th.....	Cape Fear River Entrance (whistle), N. C.
	Barge Wreck, R. I.		Paris Island Spit, S. C.
	Brownstone Wreck, Conn.		Turn, S. C.
	Coal Barge Wreck, N. Y.	7th.....	Channel, 2B (bell), Fla.
	Coal Barge Wreck, N. Y.		Mullet Key (bell), Fla.
	Exeter Wreck, R. I.		Turn, 6 (bell), Fla.
	Mudscow Wreck, N. Y.	8th.....	Galveston Bay Channel First Turn, 2, Tex.
	M. V. B. Chase Wreck, N. Y.		Galveston, 8, Tex.
	Plum Point, 1A, N. Y.		Galveston North Jetty, 2, Tex.
	Shrewsbury Rocks (bell), N. J.		Sabine Bank East End (whistle), La.
	Wreck, N. Y.		Sabine Pass (whistle), La.
4th.....	Ben Davis Point Shoal, 16, N. J.		Texas City Channel, 1, Tex.
	Cedar Beach, Del.	9th.....	Gallardo Shoal, 1 (whistle), P. R.
	Listons Range, 2L (bell), N. J.		Santa Elena Shoal, 3, P. R.
	Schooner Ledge Rock, N. J.		Tourmaline Reef, 1, P. R.
5th.....	Barge Ivie Wreck, Va.	10th.....	Sandusky Inner, 26, Ohio.
	Brewerton Channel, 3B, 12B (bell), Md.		
	Craighill Channel, 9C (bell), Md.		
	Cutoff Channel, 13K (bell), Md.		
	Cutoff Channel, Entrance, 5K (bell) Md.		

GAS BUOYS ESTABLISHED AND DISCONTINUED DURING THE FISCAL YEAR 1916—
Continued.

District.	Location.	District.	Location.
ESTABLISHED (89)—continued.		DISCONTINUED (56)—continued.	
11th.....	Chas. S. Price Wreck, Mich. Eagle River Shoals (bell), Mich. East Alpena Channel, 1, Mich. Fighting Island Channel, 2, 6, 8 (3), Mich. Portage River, 45, Mich.	3d (con.)...	Coal Barge Wreck, N. Y. Exeter Wreck, R. I. M. V. B. Chase Wreck, N. Y. Mudscow Wreck, N. Y. Wreck, N. Y.
12th.....	Chambers Island West Shoal (bell), Wis. East Bank, 5, Wis. Garden Island Shoal (bell), Mich. Green Bay Harbor Outer, 1A, Wis. West Bank, 6, Ind.	4th.....	Ben Davis Point Shoal, 16 (bell), N. J. Listons Range, 2L, N. J.
16th.....	Cape St. Elias, 2 (whistle and submarine bell), Alaska.	5th.....	Brewerton Channel, 3B, 12B (2), Md. Cambridge Channel, 2 (bell), Md. Craighill Channel, 9C, Md. Cutoff Channel, 13K, Md. Cutoff Channel Entrance, 5K, Md. Elizabeth River Entrance, 2A, Va. Fort McHenry Channel, 4M, Md. Horseshoe Shoal, 2, Va. Katahdin Wreck, Va. N. H. Burrow Wreck, Va. Stone Barge Wreck, Va. Sunken Raft Wreck (bell), Md. Tangier Island Shoal Lump, 12TL, Md. Target Range, 5A, Md. Washingtonian Wreck, Del.
17th.....	Clatsop Spit, 12, Wash. Main Channel, 2 (whistle), Oreg. Point Glover, 1, Wash. Post Point, 2 (bell), Wash. South Jetty, 2S (whistle), Oreg. Upper Sands, 4, Oreg.	6th.....	South Side, 17, S. C. Upper Middle Ground, 12, S. C.
18th.....	City of Panama Wreck, Cal. Indian Island Spit, Cal.	7th.....	Mullet Key, Fla.
19th.....	Blonde Reef, 1BR (bell), Hawaii. Lahaina, 2, Hawaii.	8th.....	Galveston, 8, Tex. Galveston North Jetty, 2, Tex. Sabine Bank East End, La. Theodore Weems Wreck (whistle), La.
DISCONTINUED (56).		10th.....	Buffalo Light Vessel Wreck, N. Y.
1st.....	Sears Island Ledge, 3, Me.	11th.....	Livingstone Channel Light No. 9, Temporary, Mich.
2d.....	Bombay Wreck, Mass. Canal Breakwater, 2, Mass. Cataumet, 2, Mass. Cleveland Ledge, 7, Mass. Cleveland Ledge, 7 (bell), Mass. Geo. P. Hudson Wreck (bell), Mass. Lackawana Wreck (bell), Mass. Stone Horse Shoal North End, 5A, Mass.	12th.....	Garden Island Shoal, Mich. Iowa Wreck, Ill. South Bank, 9, Ind.
3d.....	Yankee Wreck, Mass. Abbie Wreck, N. Y. Alex. Gibson Wreck, N. J. Barge Wreck, N. Y. Barge Wreck, R. I. Brownstone Wreck, Conn. Coal Barge Wreck, N. Y.	17th.....	South Channel, 2S (whistle), Oreg. South Jetty, 2 (whistle), Oreg. South Jetty, 2S (whistle), Oreg.
		18th.....	Indian Island Spit, 7, Cal. Peninsula Point, 1 (bell), Cal.

GAS BUOYS WHICH WILL PROBABLY BE ESTABLISHED DURING THE
FISCAL YEAR 1917.

District.	Location.	District.	Location.
1st.....	Southeast Rock, off Petit Manan (whistle), Me.	16th.....	Channel Rock, Sitka Sound, Alaska. Morris Reef, Chatham Strait (bell), Alaska.
2d.....	Cape Ann (whistle), Mass. The Graves, Boston Harbor Approach (whistle), Mass. Point Allerton Bar, Boston Harbor (bell), Mass.		North Rock Shoal, Orca Inlet, Alaska. Orca Inlet, Prince William Sound, Alaska. Potter Rock, Tongass Narrows, Alaska.
4th.....	Hamburg Cove (2), Del.		Poundstone Rock, Favorite Channel (bell), Alaska.
5th.....	Horseshoe Shoal, Hampton Roads Approach (bell), Va.		Reef Island Reef, Prince William Sound, Alaska.
8th.....	Brazos River (2, 1 bell), Tex. Caucus Cut Entrance (whistle), Fla. Mobile Entrance (whistle), Ala. Navy Yard Outer Bank, Pensacola Bay (bell), Fla.	17th.....	Grays Harbor Outside Bar (whistle), Wash. Whitcomb Flats, Grays Harbor (bell), Wash.
9th.....	Grampus Shoal, Virgin Passage, W. I.		Duwamish Head, Seattle Harbor, (bell), Wash.
11th.....	Calcite Harbor, Lake Huron, Mich. Fighting Island Channel, Detroit River (3), Mich.	18th.....	North Spit, Humboldt Bay (bell), Cal.
12th.....	Gravelly Island, Poverty Island Passage, Mich. Outer Shoal, Porte des Morts Passage Approach (bell), Wis. West Bank, Green Bay City Approach, Wis.	19th.....	Point Buchon (whistle), Cal. Wahee Reef, Kahului Harbor, Maui Island, Hawaii.

**FOG SIGNALS ESTABLISHED, IMPROVED, AND DISCONTINUED DURING
THE FISCAL YEAR 1916.**

District.	Location.	Character.	
ESTABLISHED (7).			
2d.....	Stone Horse Shoal Light Vessel No. 5, Mass.	8-inch air whistle.	
3d.....	Windmill Point, Mass.....	Bell operated by electricity.	
8th.....	Rondout North Dike, N. Y.....	Bell struck by machinery.	
10th.....	Point au Fer Reef, La.....	Bell operated by clockwork.	
11th.....	Cleveland East Entrance, Ohio.....	Electric siren.	
17th.....	Ashland Breakwater, Wis.....	Do.	
	Point Hudson, Wash.....	3d-class reed horn.	
IMPROVED (11).			
		From—	To—
2d.....	Cape Ann, Mass.....	10-inch air whistle.	Air diaphone.
3d.....	Hedge Fence Light Vessel No. 9, Mass..	1st-class air siren.	8-inch air whistle.
	Scotland Light Vessel No. 11, N. J.....	Bell (hand).	Bell struck by machinery.
5th.....	Cape Charles City Harbor Northern, Va.	Bell operated by clockwork.	Bell operated electrically.
6th.....	Charleston Light Vessel No. 34, S. C....	8-inch air chime whistle.	Air diaphone.
7th.....	Egmont Key, Fla.....	Horn (hand).	Bell struck by machinery.
11th.....	Lake St. Clair Light Vessel No. 75, Mich.	Bell rung by hand.	Do.
	Two Harbors Breakwater, Minn.....	Bell struck by machinery.	Electric siren.
12th.....	Chicago Harbor, Ill.....	10-inch chime whistle.	10-inch steam chime whistle.
	do.....	10-inch steam chime whistle.	12-inch steam whistle.
17th.....	Robinson Point, Wash.....	12-inch steam whistle.	3d-class reed horn.
DISCONTINUED (2).			
2d.....	Shovelful Shoal Light Vessel No. 3, Mass.	Bell or horn.	
8th.....	Southwest Reef, La.....	Bell operated by clockwork.	

**FOG SIGNALS WHICH WILL PROBABLY BE ESTABLISHED DURING THE
FISCAL YEAR 1917.**

District.	Location.	Character.
2d.....	Wings Neck, Mass.....	Reed horn.
3d.....	Hunts Point, N. Y.....	Bell operated electrically.
10th.....	Oswego Breakwater, N. Y.....	Steam whistle or air diaphone.
11th.....	Eagle River Shoals, Mich.....	Electric siren.
12th.....	Manistique Breakwater, Mich.....	1st-class air diaphone.
16th.....	Cape St. Elias, Alaska.....	1st-class air siren.
17th.....	Kellett Bluff, Wash.....	3d-class reed horn.
18th.....	San Antonio Creek, Cal.....	Horn operated electrically.

**LIGHT VESSELS ESTABLISHED AND DISCONTINUED DURING THE
FISCAL YEAR 1916.**

District.	Number of vessel.	Name of station.
ESTABLISHED (1).		
2d.....	5	Stone Horse Shoal, Mass.
DISCONTINUED (1).		
2d.....	3	Shovelful Shoal, Mass.

SUBMARINE SIGNALS ESTABLISHED DURING THE FISCAL YEAR 1916.

District.	Location.	District.	Location.
2d.....	Hedge Fence Light Vessel No. 9, Mass.	16th.....	Cape St. Elias Gas, Whistling, and Submarine Bell Buoy, 2, Alaska (operated by action of sea).

SUBMARINE SIGNALS IN COMMISSION ON JUNE 30, 1916.

[Unless otherwise stated, these signals are operated by compressed air (52 signals).]

District.	Location.	District.	Location.
1st.....	Manana Island Gas, Whistling, and Submarine Bell Buoy, 14M, Me. (operated by action of sea).	6th.....	Brunswick Light Vessel No. 84, Ga. Frying-Pan Shoals Gas, Whistling, and Submarine Bell Buoy, 2A, FP, N. C. (operated by action of sea).
2d.....	Portland Light Vessel No. 74, Me. Boston Light Vessel No. 54, Mass. Great Round Shoal Light Vessel No. 86, Mass. Hedge Fence Light Vessel No. 9, Mass. Nantucket Shoals Light Vessel No. 85, Mass. Peaked Hill Submarine Bell Buoy, 2A, Mass. (operated by action of sea). Pollock Rip Light Vessel No. 47, Mass. Pollock Rip Blue Light Vessel No. 73, Mass. Vineyard Sound Light Vessel No. 41, Mass.		Frying-Pan Shoals Light Vessel No. 94, N. C. Martins Industry Light Vessel No. 1, S. C. St. Johns Gas, Whistling, and Submarine Bell Buoy, St. J., Fla. (operated by action of sea).
3d.....	Ambrose Channel Light Vessel No. 87, N. Y. Barnegat Shoal Gas, Whistling, and Submarine Bell Buoy, 7B, N. J. (operated by action of sea). Brenton Reef Light Vessel No. 39, R. I. Cornfield Point Light Vessel No. 48, Conn. Fire Island Light Vessel No. 68, N. Y. Five-Fathom Bank Light Vessel No. 79, N. J. Northeast End Light Vessel No. 44, N. J. Overfalls Light Vessel No. 69, Del. Point Judith Gas, Whistling, and Submarine Bell Buoy, 2, R. I. (operated by action of sea).	8th.....	Heald Bank Light Vessel No. 81, Tex. South Pass Entrance Gas, Whistling, and Submarine Bell Buoy, La. (operated by action of sea). Southwest Pass Light Vessel No. 43, La.
5th.....	Cape Charles Light Vessel No. 49, Va. Cape Lookout Shoals Light Vessel No. 80, N. C. Chesapeake Bay Entrance Gas, Whistling, and Submarine Bell Buoy, 2CB, Va. (operated by action of sea). Diamond Shoal Light Vessel No. 71, N. C. Fenwick Island Shoal Light Vessel No. 52, Del. Tail of the Horseshoe Light Vessel No. 46, Va. 35-Foot Channel Light Vessel No. 45, Va. Winter-Quarter Shoal Light Vessel No. 91, Va.	11th.....	Detour Light Station, Mich. (operated electrically from the shore). Lake Huron Light Vessel No. 61, Mich. Martin Reef Light Vessel No. 89, Mich. Poe Reef Light Vessel No. 96, Mich. Whitefish Point Light Station, Mich. (operated electrically from the shore).
		12th.....	Eleven-Foot Shoal Light Vessel No. 60, Mich. Grays Reef Light Vessel No. 57, Mich. Lansing Shoal Light Vessel No. 55, Mich. North Manitou Shoal Light Vessel No. 56, Mich. White Shoal Light Station, Mich. (operated electrically from lighthouse).
		16th.....	Cape St. Elias Gas, Whistling, and Submarine Bell Buoy, 2, Alaska (operated by action of sea).
		17th.....	Columbia River Light Vessel No. 88, Oreg. Orford Reef Gas, Whistling, and Submarine Bell Buoy, 2 OR, Oreg. (operated by action of sea). Swiftsure Bank Light Vessel No. 93 Wash. Umatilla Reef Light Vessel No. 67 Wash.
		18th.....	Blunts Reef Light Vessel No. 83, Cal. San Francisco Light Vessel No. 70, Cal.

PRIVATE AIDS TO NAVIGATION MAINTAINED ON JUNE 30, 1916.

[Under the act of June 20, 1906.]

District.	Lights.	Buoys.		Other unlighted aids.	Fog signals.	Total.
		Lighted.	Unlighted.			
1st.....			33	1		36
2d.....	34		30	12		76
3d.....	30	11	48	2	2	93
4th.....			1			1
5th.....	19	13	37	65	3	137
6th.....			1			1
7th.....	4		9	4		17
8th.....	12		16	12		40
9th.....			1			1
10th.....	18		4		4	26
11th.....	1	5	54	1		61
12th.....	41	2	8		8	59
13th.....		1				1
16th.....	2		1			3
17th.....	4		16		2	22
18th.....	19	2	1	1	10	33
19th.....	19			2		21
Total.....	210	34	260	102	29	635

BRIDGES OVER NAVIGABLE WATERS LIGHTED ON JUNE 30, 1916.

[Under the act of Aug. 7, 1882, 22 Stat., 309.]

District.	Lighted bridges.	District.	Lighted bridges.	District.	Lighted bridges.
1st.....	17	8th.....	259	15th.....	8
2d.....	60	9th.....	1	17th.....	52
3d.....	173	10th.....	56	18th.....	29
4th.....	15	11th.....	53		
5th.....	40	12th.....	227	Total.....	1,311
6th.....	54	13th.....	74		
7th.....	15	14th.....	178		

AIDS MAINTAINED UNDER CONTRACT DURING THE FISCAL YEAR 1916.

District.	Name of aids.	Annual cost.
6th.....	Little River Inlet, N. C. (4 bar buoys).....	\$1.00
10th.....	Lake Ontario and the St. Lawrence River, N. Y. (37 buoys).....	1,900.00
	Niagara River and Black Rock Channel, N. Y. (74 buoys).....	1,136.75
11th.....	Superior Bay, St. Louis Bay and River, Wis. and Minn. (30 lights).....	2,000.00
12th.....	Fox River, Wis. (14 spar buoys); Green Bay, Wis. (18 spar buoys).....	160.00
16th.....	Cooks Inlet, Alaska (3 lights).....	102.50
	St. Michael Canal and Apoon Pass, Alaska (32 buoys), and Orizaba Reef Bell Buoy.....	428.00
	Norton Sound (12 lights).....	775.00
18th.....	Hookton Channel Range Rear Light, Cal.....	1.00
19th.....	Lahaina Buoy Light, Hawaii.....	1.00

LIGHT VESSELS IN COMMISSION DURING THE FISCAL YEAR 1916.

Number.	Station.	District.	Tonnage.		When built.	Material of hull.	Dimensions.			Indicated horsepower (self-propelling).	Regular complement.		Fog signal.	Illuminant.	Cost of repairs made during fiscal year.	Cost of maintenance during fiscal year.	Original cost.	On station.	
			Gross.	Net.			Length over all.	Breadth.	Depth.		Officers.	Crew.						Months.	Days.
74	Portland, Me.	1	a 495		1902	Wood	Fl. in. 120 9	Fl. in. 28 6	Fl. in. 13 0	380	4	8	12" steam whistle b.	Acet.	\$82	\$10,594	\$88,896	12	
3	Relief.	2	140		1852	do.	c 69 4	23 0	10 0	(d)	0	1	Bell or horn.	Oil.	251	4,761	12,000	11	1
4	Handkerchief, Mass.	2	104		1855	do.	c 77 0	20 0	10 0	(d)	2	5	do.	do.	36	4,764		12	
5	Stone Horse Shoal, Mass.	2	104		1864	do.	c 80 6	21 6	9 0	(d)	2	6	8" air whistle.	do.	1,794	3,301		4	13
6	Cross Rip, Mass.	2	120		1852	do.	c 80 0	24 0	10 0	(d)	2	6	do.	Acet.	6,005	5,030		8	17
9	Hedge Fence, Mass.	2	104		1857	do.	c 81 2	28 2	9 6	(d)	2	5	do. b.	Oil.	829	5,797	19,883	12	
41	Vineyard Sound, Mass.	2	387		1876	do.	120 6	26 9	11 0	(d)	2	6	First-class air siren b.	do.	592	6,387	33,000	10	17
42	Hen and Chickens, Mass.	2	410		1877	do.	121 7	26 6	10 6	(d)	3	7	10" air whistle.	do.	621	7,981	40,796	11	13
47	Follock Rip, Mass.	2	a 470		1891	Comp.	120 10	26 6	11 0	(d)	4	6	12" steam chime wh. b.	do.	391	8,926	60,000	10	11
54	Boston, Mass.	2	310		1892	Steel.	118 10	26 0	11 0	150	4	7	First-class air siren b.	Inc. o. v.	305	10,709	62,030	10	22
66	Relief.	2	a 590		1896	Comp.	123 0	28 6	13 0	350	2	6	12" steam chime wh. b.	Fl. or o.	4,597	7,647	69,252	4	21
73	Pollock Rip Shoal, Mass.	2	a 598		1901	Steel.	123 9	28 6	12 9	400	4	8	do.	Oil.	2,738	11,541	79,872	9	21
85	Nantucket Shoals, Mass.	2	246	246	1907	do.	135 5	29 0	13 0	380	5	10	do. b.	Fl. inc.	347	14,593	99,000	10	18
86	Great Round Shoal, Mass.	2	a 683	246	1907	do.	135 5	29 0	13 0	380	4	8	do. b.	Oil.	1,511	12,533	99,000	8	3
90	Relief.	2	a 685	225	1908	do.	135 5	29 6	13 0	400	2	6	do. b.	do.	264	8,739	107,213	8	1
11	Scotland, N. J.	3	320		1853	Wood	c 104 0	24 8	11 6	(d)	2	6	Bell.	Oil and oil gas.	1,240	5,663	13,462	11	24
13	Bartlett Reef, Conn.	3	155		1854	do.	c 79 8	21 8	10 4	(d)	2	5	do.	Oil.	6	4,660	12,000	12	
16	Relief.	3	250		1854	do.	c 103 6	22 6	11 0	(d)	0	1	First-class air siren, 6" whistle, b.	do.	7,517	1,619	28,064	5	
20	do.	3	165		1867	do.	c 81 6	21 6	10 0	(d)	0	1	Bell.	do.	854	442	25,040	2	1
23	Ram Island Reef, N. Y.	3	186		1857	do.	c 94 2	24 0	9 0	(d)	2	5	do.	do.	750	4,954	7,500	10	
39	Brenton Reef, R. I.	3	387		1875	do.	119 6	26 9	13 0	(d)	4	6	12" and 6" steam wh. b.	do.	993	8,682	42,200	10	14
44	Northeast End, N. J.	3	197		1882	Iron.	115 6	25 0	10 6	(d)	4	7	First-class steam siren b.	Acet.	2,815	8,695	50,000	9	1
48	Cornfield Point, Conn.	3	a 470		1891	Comp.	120 10	27 8	12 0	(d)	3	7	First-class air siren b.	Acet. and oil.	644	8,816	52,780	10	14
51	Relief.	3	283		1892	Iron	118 10	26 9	11 0	135	2	5	12" steam whistle b.	Fl. inc.	710	11,355	53,325	9	27
68	Fire Island, N. Y. ©	3	a 590	204	1897	Comp.	122 10	28 6	12 6	350	4	10	12" steam chime wh. b.	do.	1,080	11,502	74,750	10	9
69	Overfalls, Del.	3	a 590	204	1897	do.	122 10	29 6	13 0	350	4	10	do. b.	do.	1,641	11,971	79,500	6	22
78	Relief.	3	a 668	188	1904	do.	120 0	28 6	12 6	325	2	5	12" steam whistle b.	Oil or acet.	562	7,630	89,030	10	13

LIGHT VESSELS.

47

79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000	1001	1002	1003	1004	1005	1006	1007	1008	1009	1010	1011	1012	1013	1014	1015	1016	1017	1018	1019	1020	1021	1022	1023	1024	1025	1026	1027	1028	1029	1030	1031	1032	1033	1034	1035	1036	1037	1038	1039	1040	1041	1042	1043	1044	1045	1046	1047	1048	1049	1050	1051	1052	1053	1054	1055	1056	1057	1058	1059	1060	1061	1062	1063	1064	1065	1066	1067	1068	1069	1070	1071	1072	1073	1074	1075	1076	1077	1078	1079	1080	1081	1082	1083	1084	1085	1086	1087	1088	1089	1090	1091	1092	1093	1094	1095	1096	1097	1098	1099	1100	1101	1102	1103	1104	1105	1106	1107	1108	1109	1110	1111	1112	1113	1114	1115	1116	1117	1118	1119	1120	1121	1122	1123	1124	1125	1126	1127	1128	1129	1130	1131	1132	1133	1134	1135	1136	1137	1138	1139	1140	1141	1142	1143	1144	1145	1146	1147	1148	1149	1150	1151	1152	1153	1154	1155	1156	1157	1158	1159	1160	1161	1162	1163	1164	1165	1166	1167	1168	1169	1170	1171	1172	1173	1174	1175	1176	1177	1178	1179	1180	1181	1182	1183	1184	1185	1186	1187	1188	1189	1190	1191	1192	1193	1194	1195	1196	1197	1198	1199	1200	1201	1202	1203	1204	1205	1206	1207	1208	1209	1210	1211	1212	1213	1214	1215	1216	1217	1218	1219	1220	1221	1222	1223	1224	1225	1226	1227	1228	1229	1230	1231	1232	1233	1234	1235	1236	1237	1238	1239	1240	1241	1242	1243	1244	1245	1246	1247	1248	1249	1250	1251	1252	1253	1254	1255	1256	1257	1258	1259	1260	1261	1262	1263	1264	1265	1266	12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TENDERS OF THE LIGHTHOUSE SERVICE IN COMMISSION DURING THE FISCAL YEAR 1916.

Name.	District.	Displacement.		When built.	Description.	Material of hull.	Dimensions.			Mean draft.		Indicated horsepower.	Regular complement.		Miles steamed.	Coal consumed for all purposes.	Cost of repairs.	Cost of maintenance.	Original cost.
		Light.	Loaded.				Length overall.	Breadth.	Depth.	Light.	Loaded.		Officers.	Crew.					
Hibiscus.....	1	Tons, 818	Tons, 1,081	1908	Steamer, twin screw.	Steel.	Feet, 190	Feet, 30	Feet, 16	Feet, 11	Feet, 13	1,000	6	23	14,406	1,737	\$2,191	\$36,916	\$184,643
Zizania.....	1	575	643	1888	do.....	do.....	161	27	12	8	9	650	5	20	10,619	1,310	4,048	30,256	48,739
Anemone.....	2	818	1,053	1908	do.....	do.....	190	30	16	11	0	1,000	7	23	14,793	1,833	2,557	35,170	191,999
Azalea.....	2	330	516	1891	Steamer, single screw.	do.....	154	25	12	6	9	400	5	19	10,559	790	1,436	26,278	79,792
Mayflower.....	2	630	668	1897	Steamer, twin screw.	do.....	164	30	12	7	9	650	5	22	10,065	1,481	1,170	30,387	74,872
Daisy.....	3	61	81	1892	Steamer, single screw.	Wood.	80	14	5	4	0	60	2	4	8,100	114	943	6,910	6,500
Gardenia.....	3	217	245	1879	do.....	do.....	117	20	9	6	0	200	4	11	10,998	583	936	16,160	11,000
John Rodgers.....	3	455	571	1883	Steamer, side wheel.	Iron.	160	27	9	6	6	260	4	16	7,972	787	1,247	20,543	59,987
Larkspur.....	3	738	888	1903	Steamer, twin screw.	Steel.	169	30	14	9	1	750	6	22	3,987	521	25,776	13,476	123,259
Mistletoe.....	3	455	476	1872	Steamer, side wheel.	Wood.	160	26	9	6	9	370	4	16	6,984	649	762	18,955	45,833
Pansy.....	3	431	454	1878	Steamer, twin screw.	Iron.	152	25	11	7	7	250	4	17	12,374	902	3,218	18,515	48,739
Tulip.....	3	774	1,142	1908	do.....	Steel.	190	30	16	10	7	1,000	6	24	15,975	2,194	1,222	35,392	191,658
Lilac d.....	3	461	643	1892	Steamer, single screw.	do.....	155	27	15	10	0	800	1	3	.....	48	86	3,926	92,125
Iris.....	4	519	606	1897	do.....	do.....	153	30	10	8	7	800	4	19	12,740	1,496	3,893	24,875	84,407
Woodbine.....	4	85	107	1913	Gasoline, single screw.	Wood.	95	16	7	5	2	125	2	4	7,027	18	2,593	8,521	24,728
Holly.....	5	431	499	1881	Steamer, side wheel.	Comp.	176	24	10	7	0	400	4	16	10,116	817	4,185	20,178	41,911
Ivy.....	5	736	916	1904	Steamer, twin screw.	Steel.	173	30	13	7	11	700	5	22	.....	236	268	16,501	123,860
Jessamine.....	5	369	403	1881	Steamer, side wheel.	Iron.	156	24	10	7	3	350	4	16	10,738	946	1,693	20,053	41,911
Juniper.....	5	125	146	1903	Steamer, twin screw.	Steel.	95	18	8	4	6	200	2	5	8,507	549	1,517	9,428	29,425
Laurel.....	5	218	299	1915	Steamer, single screw.	Wood.	105	22	9	6	1	160	4	8	11,810	381	2,740	13,911	55,502
Maple.....	5	567	799	1893	Steamer, twin screw.	Steel.	164	30	12	7	3	650	6	22	8,299	834	9,738	27,637	93,889
Orchid.....	5	818	1,081	1908	do.....	do.....	190	30	16	11	0	1,000	6	23	19,883	2,280	3,569	32,922	186,151
Cypress C.....	6	716	1,060	1908	do.....	do.....	190	30	16	10	1	1,000	7	23	17,639	2,284	6,021	40,041	191,633
Mangrove.....	6	549	682	1897	do.....	do.....	164	30	12	7	0	550	5	22	14,392	1,618	2,855	31,561	74,998
Snowdrop.....	6	30	41	1896	Gasoline, single screw.	Wood.	69	11	5	2	11	32	2	2	9,087	1,640	646	4,997	9,700
Water Lily.....	6	29	39	1895	do.....	do.....	64	11	5	2	11	36	2	2	9,278	1,570	561	5,277	9,261

Arbutus.....	7	398	545	1879	Steamer, twin screw..	do.....	153	25	11	7	1	9	0	360	5	19	11,417	925	1,609	29,608	49,769
Camellia.....	8	276	377	1911	do.....	Steel..	117	24	10	5	10	7	7	280	4	12	5,033	497	4,749	20,509	57,412
Magnolia.....	8	685	877	1904	do.....	do.....	173	30	13	7	6	9	2	700	5	22	11,434	1,576	3,882	31,837	124,874
Sunflower.....	8	728	986	1907	do.....	do.....	174	31	15	9	8	12	1	900	7	22	12,594	1,853	649	36,772	124,958
Myrtle.....	9	435	542	1872	Steamer, single screw..	Wood..	140	25	11	9	6	11	0	225	4	17	10,473	847	1,645	24,637	44,500
Crocus.....	10	681	1000	1904	Steamer, twin screw..	Steel..	165	29	14	9	6	10	6	700	6	22	7,324	1,418	3,910	29,682	119,718
Amaranth.....	11	597	975	1892	Steamer, single screw..	do.....	166	28	14	8	6	12	6	672	5	19	5,789	932	5,350	24,639	74,994
Aspen.....	11	353	415	1906	do.....	do.....	126	25	12	7	3	8	3	440	4	10	9,200	557	4,600	15,240	70,573
Clover.....	11	163	205	1899	do.....	Wood..	93	22	7	5	4	6	4	140	4	8	12,070	398	698	12,286	84,871
Marigold.....	11	477	696	1890	do.....	Iron...	160	27	12	8	7	11	3	550	5	19	14,320	1,094	1,782	24,568	84,871
Hyacinth.....	12	493	914	1903	do.....	Steel..	165	28	14	7	0	11	6	500	5	19	9,026	1,300	6,371	27,274	115,000
Sumac.....	12	600	887	1903	Steamer, twin screw..	do.....	169	30	13	8	10	11	9	700	5	22	9,061	1,570	3,153	30,969	114,992
Goldenrod A.....	13, 14	194	283	1888	Steamer, stern wheel..	do.....	169	27	4	2	5	3	4	152	.....	.....	.....	.....	.....	33,221	.....
Oleander.....	15	463	548	1903	do.....	do.....	189	34	7	3	10	4	6	600	3	15	17,134	2,162	2,265	22,703	60,000
Kukul ○.....	16	838	935	1908	Steamer, twin screw..	do.....	190	30	16	11	2	12	0	1,000	7	22	13,475	2,229	2,614	54,306	213,880
Fern.....	16	245	317	1915	Steamer, single screw..	Wood..	112	22	10	7	1	8	6	360	4	8	14,027	2,607	353	18,765	62,100
Heather.....	17	631	831	1903	do.....	do.....	179	28	15	9	6	11	6	685	5	19	11,344	1,390	462	32,568	118,568
Manzanita.....	17	774	1,000	1908	Steamer, twin screw..	do.....	190	30	16	10	7	12	7	1,000	6	23	12,082	2,024	3,097	40,631	211,817
Madrono.....	18	654	806	1885	Steamer, single screw..	Iron...	180	27	15	9	9	11	6	750	6	19	7,532	1,005	5,888	35,678	87,872
Sequoia.....	18	809	1,100	1908	Steamer, twin screw..	Steel..	190	30	16	10	11	13	5	1,000	6	23	10,888	1,342	5,440	44,396	213,409
Columbine ○.....	19	429	643	1892	Steamer, single screw..	do.....	155	27	15	9	6	12	3	800	6	19	10,206	837	6,537	38,900	93,993

a Light=without cargo and deck loads, and a minimum supply of stores, provisions, water, and coal.
b Loaded=bunkers full of coal, all tanks, including trimming tanks, full of water; full stores and provisions, and an average maximum cargo and deck load.
c Length between perpendiculars.
d Laid up.
e Also 11,846 gallons gasoline.
f Gallons gasoline.
g Displacement (fresh water).
h In use by U. S. Engineer Department.
i Barrels of oil=109,494 gallons.
○ Equipped with radio.

LIGHTHOUSE VESSELS SOLD DURING THE FISCAL YEAR 1916.

Relief light vessel No. 29, formerly stationed in the fifth lighthouse district, was surveyed and condemned as unserviceable and of no further use to the Service, and sold on September 15, 1915, to the highest bidder for \$1,667.67.

CONSTRUCTION OF TENDERS AND LIGHT VESSELS.

Tender "Palmetto."—Acts of May 27, 1908, and March 4, 1909, appropriated \$200,000 for one tender, and the acts of July 27, 1912, and March 3, 1915, authorized the use of this amount for the construction of two or more tenders for general service. Plans were prepared for a light-draft tender for use in the inside waters of the sixth district, and on September 3, 1915, a contract was awarded to the Merrill-Stevens Co., Jacksonville, Fla., in the sum of \$28,975. The vessel was launched June 30, 1916. Amount expended to June 30, 1916, \$9,312.19.

Tender.—The appropriation of \$30,000, made by the act of May 27, 1908, for a tender for the engineer sixth lighthouse district or elsewhere, will probably be used for the purchase of a small tender for general service use. Expenditures for plans under this appropriation to June 30, 1916, amounted to \$3,133.36.

Tender "Cedar."—The act of January 25, 1915, appropriated \$250,000 for a lighthouse tender for general service. Plans and specifications were immediately prepared for a first-class seagoing tender, for service in Alaska, and on May 4, 1915, a contract was awarded for its construction to the Craig Shipbuilding Co., Long Beach, Cal.; in the sum of \$234,500. Amount expended to June 30, 1916, \$108,507.62.

Tender "Rose."—Acts of May 27, 1908, and March 4, 1909, appropriated \$200,000 for one tender, and the act of July 27, 1912, authorized the use of this amount for the construction of two tenders for general service. As one of these, plans and specifications were completed for a tender of moderate size and draft for use in the small harbors and inside waters of the coasts of Oregon and Washington, and on November 6, 1914, a contract was awarded for its construction to Anderson Steamboat Co., Seattle, Wash., in the sum of \$87,950. The vessel was launched February 19, 1916, and was nearly completed at the close of the fiscal year. Amount expended to June 30, 1916, \$54,284.91.

Tender "Aster" and barge.—The act of July 1, 1916, appropriated \$20,000 for constructing or purchasing and equipping a small tender and barge for the eighth district, Texas and Louisiana. It is proposed to purchase a suitable vessel for a tender, and construct the barge from plans and specifications now in preparation.

Light vessel "No. 99."—The act of August 24, 1912, appropriated \$130,000 for a light vessel for general service. Plans and specifications were prepared for a light vessel for the Great Lakes. Bids were received on May 25, 1916, and on June 29, 1916, a contract was awarded to Rice Bros., East Boothbay, Me., in the sum of \$61,000. Amount expended to June 30, 1916, \$5,225.68.

Light vessel "No. 100."—Plans and specifications are in preparation for a large light vessel for station at Nantucket Shoals, Mass. There is a balance of \$51,600 remaining under the appropriation of August 26, 1912, for light vessels, but on account of the present excessively high cost of materials it will not be possible to construct the vessel from this available balance. No expenditures were made to June 30, 1916.

Light vessel "No. 101."—Act of August 26, 1912, appropriated \$250,000 for light vessels for general service. Plans and specifications were prepared for a second-class vessel for general relief duty on the Atlantic coast, to be assigned to the light-vessel station off Cape Charles, Va., and on March 6, 1915, a contract was awarded for its construction to the Pusey & Jones Co., of Wilmington, Del., in the sum of \$93,699. The vessel was launched January 12, 1916, and was nearing completion at the close of the fiscal year. Amount expended to June 30, 1916, \$108,507.62.

Light vessel "No. 102" (Southwest Pass).—The act of October 22, 1913, appropriated \$125,000 for a light vessel for the Southwest Pass entrance to the Mississippi River, La. Plans and specifications for a vessel generally similar to No. 101 were prepared, and on March 6, 1915, a contract was awarded for its construction to the Pusey & Jones Co., of Wilmington, Del., in the sum of \$93,699. The vessel was launched November 27, 1915. Amount expended to June 30, 1916, \$65,739.09.

SPECIAL WORKS OF CONSTRUCTION COMPLETED (OMITTING VESSELS).

Oil houses for light stations.—The acts of May 27, 1908, March 4, 1909, and June 25, 1910, each appropriated \$10,000 for establishing isolated oil houses for the storage of kerosene, etc. During the fiscal year oil houses were completed at the following-named stations:

	Amount expended.		Amount expended.
Dutch Island, R. I.....	\$465. 97	Watch Hill, R. I.....	\$304. 95
Little Gull Island, N. Y.....	459. 75	San Juan Depot, P. R.....	215. 31

Light keepers' dwellings.—The act of May 27, 1908, appropriated \$75,000 for light keepers' dwellings and appurtenant structures, including sites therefor. The last dwelling built under this appropriation was at Barbers Point Light Station, Oahu, Hawaii, completed June 26, 1915, at a cost of \$3,198.95. On June 30, 1916, the unexpended balance under this appropriation was \$2.22, which was covered into the surplus fund in the Treasury.

THIRD DISTRICT.

Point Judith Breakwater, R. I.—The act of March 4, 1909, appropriated \$12,000 for establishing lights and fog signals on the breakwater of the Harbor of Refuge, Point Judith, R. I. Four lights were completed and went into commission on October 22, 1912. One additional light (West Breakwater Light) was completed and went into commission on July 10, 1915. The structures consist of hollow cast-iron columns with a tank house around the top for holding the acetylene gas tanks. The total cost to June 30, 1916, was \$11,928.54.

Staten Island, N. Y., and West Bank, N. J.—The acts of June 30, 1906, and March 4, 1909, each appropriated \$50,000 for a lighthouse on Staten Island, N. Y., and the raising of West Bank Light, N. J. This act of June 30, 1906, also appropriated \$10,000 for a temporary structure to maintain West Bank Light while being raised, and a temporary structure for North Hook Light while being moved. All the work has been completed, and Staten Island Light Station went into commission on April 15, 1912. Details of construction and apparatus were included in annual report for 1912. Amount expended to June 30, 1916, \$73,972.64.

Staten Island Lighthouse Depot, N. Y.—The act of March 4, 1911, appropriated \$30,000 for constructing a power house and foundry, and for completing the equipment, wiring, etc., of the power plant at the general lighthouse depot, Tompkinsville, N. Y. The work has all been completed. Details of construction, etc., of the power house and foundry were included in annual report for 1914. The total cost to June 30, 1916, was \$29,545.72.

Stonington, Conn.—The act of March 4, 1911, appropriated \$500 for the repair of the sea wall at Stonington Point, Conn. The work was completed in November, 1915. Amount expended to June 30, 1916, \$499.37.

Rondout Creek, Hudson River, N. Y.—The act of March 4, 1911, appropriated \$40,000 for establishing a light and fog-signal station at or near the mouth of Rondout Creek, Hudson River, N. Y. The work was started in March, 1914, and the light was put in commission on August 25, 1915. All work was completed in March, 1916. Amount expended to June 30, 1916, \$33,575.81.

FIFTH DISTRICT.

Norfolk Harbor, Va.—The act of March 4, 1911, appropriated \$35,000 for establishing an adequate system of lighting in the channel leading to Norfolk Harbor, Va. Under this appropriation a system of lighted buoys was purchased and established, and Bush Bluff light vessel No. 97 was fitted with a fog bell and striker and new lighting equipment. The work was completed in the spring of 1916, with the exception of one buoy not yet delivered. Amount expended to June 30, 1916, \$31,341.72.

Fort McHenry Channel, Md.—The act of March 4, 1911, appropriated \$125,000 for range lights in the Fort McHenry Channel, Md. Authority was given by Congress July 27, 1912, for the use of this appropriation for the establishment of gas buoys and other aids to navigation in the channels leading to Baltimore, Md. Under this appropriation a complete system of buoys has been purchased and established, including the necessary moorings for the same and spare buoys for relief purposes. The work was completed in the spring of 1916. Amount expended to June 30, 1916, \$124,258.04.

Chesapeake Bay Entrance, Va.—The act of May 27, 1908, appropriated \$27,000 for one buoy to be placed off Cape Henry, one buoy to be placed to the northward of the Middle Ground near the entrance to Chesapeake Bay, and one relief buoy. The

special objects named in this appropriation have been accomplished by the purchase of three lighted buoys, and the attachment of submarine bells operated by the action of the sea. Amount expended to June 30, 1916, \$26,836.27.

EIGHTH DISTRICT.

Atchafalaya Entrance Channel, La.—The act of October 22, 1913, appropriated \$50,000 for erecting aids to navigation in Atchafalaya Entrance Channel, La., and contractor commenced driving foundation piles for Point au Fer Reef Lighthouse on December 4, 1915, and the construction of Point au Fer Reef Lighthouse and Atchafalaya Entrance Channel Lights Nos. 1, 3, 5, 7, and 2, La., was completed on May 7, 1916. The foregoing contract was completed at a cost of \$18,749.75. The construction of a launch and the establishment of gas-lighted buoys along this channel has not yet been completed, although necessary steps have been taken in these matters. Amount expended to June 30, 1916, \$19,616.69.

ELEVENTH DISTRICT.

Ashland, Wis.—The act of October 22, 1913, appropriated \$25,000 for the construction of aids to navigation at Ashland, Wis. Sites were purchased for a keepers' dwelling and for a boathouse and the structure erected thereon. A reinforced concrete tower on the outer end of breakwater was completed, a submarine electric cable laid to shore, and the light and fog signal placed in commission on October 15, 1915. Work under the appropriation was completed May 31, 1916, the total amount expended to June 30, 1916, being \$24,943.80.

Superior Entry, Wis.—The act of June 30, 1906, appropriated \$20,000 for range lights at Superior Pierhead, Lake Superior, Wis. The act of March 4, 1911, appropriated \$25,000 additional for the completion of lighting of breakwaters and piers at Superior Entry, Wis. Lights on the outer north breakwater and inner north pierhead were completed and established on October 10, 1912. The main light and fog-signal station was completed and placed in commission on June 30, 1913. The inner south pierhead light was completed on October 10, 1912, and went into commission on June 12, 1914, when the remains of the old breakwater outside of it had been dredged away. An additional light at the inner end of the south canal pier and known as Superior Harbor Basin Light No. 1 was established on June 30, 1915. An additional dwelling of concrete and hollow tile was constructed within the year and is now occupied. There remain to be built, fences, etc., in connection with this dwelling. Amount expended to June 30, 1916, \$41,774.50.

TWELFTH DISTRICT.

Oconto, Wis.—The act of October 22, 1913, appropriated \$5,000 for pierhead lights, etc., Oconto Harbor, Wis. The installation of a 25-foot steel tower and flashing acetylene equipment for Oconto Harbor South Pierhead Light was completed and light placed in commission April 12, 1915, and a gas and bell buoy for Oconto Harbor Channel has been established. Amount expended to June 30, 1916, \$4,684.35.

SPECIAL WORKS OF CONSTRUCTION UNCOMPLETED (OMITTING VESSELS).

Oil houses for light stations.—The acts of May 27, 1908, March 4, 1909, and June 25, 1910, each appropriated \$10,000 for establishing isolated oil houses for the storage of kerosene. These funds are now nearly exhausted, the unexpended balance on June 30, 1916, being \$1,274.72. At the close of the fiscal year a concrete oil house with asbestos shingle roof was under construction at Point Judith Light Station, R. I., and the work will probably be completed during the present season. Amount expended to June 30, 1916, \$130.08.

SECOND DISTRICT.

Cape Cod Canal Lights, Mass.—Appropriation of \$50,000 was made by the act of August 1, 1914. At the eastern entrance, Cape Cod Bay, 2 lighted buoys with bells, 1 unlighted buoy, and an electric lens-lantern light have been established; at the western or Buzzards Bay entrance, 5 lighted buoys (two with bells), 14 lighted beacons, and 8 unlighted buoys have been placed. Upon completion of the breakwater at the eastern entrance, the light will be moved to the outer end, and an electric fog bell installed. The light at Wings Neck Light Station has been improved by the installation of oil-vapor apparatus and steps are now being taken to improve the fog signal by substituting a reed horn for the present bell. The date of completion of the project depends on the time required by the canal authorities to complete work on the breakwater. Amount expended to June 30, 1916, \$44,848.78.

THIRD DISTRICT.

Staten Island Lighthouse Depot, N. Y.—The act of August 1, 1914, appropriated \$23,000 for the erection of a new carpenter shop at the general lighthouse depot, Staten Island, N. Y. The work was started in August, 1915, and it is expected to have the building completed during the season of 1916. Amount expended to June 30, 1916, \$10,940.19.

Hunts Point, N. Y.—The act of March 4, 1911, appropriated \$5,000 for the establishment of a light and fog signal to mark Hunts Point, between Hell Gate and White-stone Point, East River, N. Y. Steps have been taken to establish an acetylene light, located on a steel tower, built on a stone and concrete foundation, as soon as necessary permits can be obtained, provision being made for a fog bell to be installed later when it is practicable to procure electric current for its operation. The date of completion is indefinite. No expenditure has been made from this appropriation.

FOURTH DISTRICT.

Joe Flogger Shoal, Del.—The act of June 20, 1906, authorized \$75,000 for establishing a light and fog signal at or near this shoal. The act of June 30, 1906, appropriated \$40,000 for this purpose, and the act of June 17, 1910, increased the limit of cost for this light and fog signal to \$105,000. An additional appropriation has not yet been made. Work on this project has been deferred, as the total amount necessary has not been appropriated and other projects are considered of greater importance. The shoal is now marked by a gas buoy. Amount expended to June 30, 1916, \$603.21.

SIXTH DISTRICT.

Depot for the sixth lighthouse district.—The act of October 22, 1913, appropriated \$125,000 for the purchase of a site and the construction of a wharf and buildings for a depot, sixth lighthouse district. During the fiscal year a creosoted timber wharf and an untreated timber bulkhead have been constructed. Obsolete buildings have been removed and deposited as riprap around the outside of the bulkhead. The depot site has been filled by hydraulic dredging and the site has been partially fenced in. One of the old buildings purchased with the site is being remodeled to be used as the depot storehouse.

The depot was occupied for lighthouse purposes August 1, 1916. Amount expended to June 30, 1916, \$120,302.11.

EIGHTH DISTRICT.

Sabine Pass Jetty, Tex.—The act of May 27, 1908, appropriated \$40,000 for a light and fog signal at or near the end of Sabine Pass Jetty. Nothing has been done on the work, in view of the proposed project of the War Department to extend the jetties to the 25-foot contour, a distance of possibly 2 miles. At the close of the fiscal year 1915 no money had been expended or obligated.

Galveston Jetty Light Station, Tex.—The act of June 11, 1896, appropriated \$35,000, and the act of May 27, 1908, \$10,000 for establishing a light and fog signal at or near the outer end of one of the jetties at Galveston Harbor, Tex. During the fiscal year great damage was done the uncompleted structure by the hurricane of August 16 to 17, 1915, which destroyed the construction wharf, bent the framework of the structure, and washed away much material. Subsequently materials were again assembled, another construction wharf erected, the framework straightened, and the work proceeded with. The structure will probably be completed during the fall of 1916. Amount expended to June 30, 1916, \$43,113.26.

NINTH DISTRICT.

Navassa Island Light Station, West Indies.—The act of October 22, 1913, appropriated \$125,000 for the erection of a light station on this island. Surveys were made and preliminary plans submitted, which were worked up into final designs in the Bureau's office. The work was advertised in July, 1915, and bids opened September 30, 1915. Contracts were awarded on October 2, 1915, for the metal work and for the erection. The contractors for erecting assembled material, engaged a schooner, and commenced operations at the site in January, 1916. During the spring of 1916 the metal work was completed and shipped, and preparatory work of building camps and construction plant at the island completed. Excavation for the foundation was commenced in May, 1916, and concrete work started shortly after the close of the fiscal year. It is expected that the work will be completed during the season of 1917. Amount expended to June 30, 1916, \$11,625.28.

TENTH DISTRICT.

Ashtabula Harbor, Ohio.—The act of October 22, 1913, appropriated \$45,000 for rearranging, rebuilding, and improvement of aids to navigation at Ashtabula Harbor,

Ohio. Work has been in progress at the site during the fiscal year, except during the winter months. On June 30, 1916, the old lighthouse structure had been moved to the new pierhead, the steel addition constructed and the interior was nearing completion. Temporary light and fog signal were in commission in rebuilt structure. It is expected to complete the structure and install new light and fog signal during the present season. Amount expended to June 30, 1916, \$29,656.71.

Cleveland Harbor, Ohio.—The act of October 22, 1913, appropriated \$17,600 for removal, reconstruction, and improvement of the fog-signal station at Cleveland, Ohio. On June 30, 1916, the structure was practically completed with the exception of plastering, miscellaneous interior work, and cleaning up. Work was in progress installing the fog-signal plant. It is expected the new fog signal will be in commission during the fall of 1916. Amount expended to June 30, 1916, \$13,012.99.

Lorain Harbor, Ohio.—The act of October 22, 1913, appropriated \$35,000 for a light and fog-signal station and improvement of aids to navigation at Lorain Harbor, Ohio. On June 30, 1916, the steel framework under contract was well advanced in the shop; contracts for cement and other materials were awarded and preparations made for starting operations at the site early in July. It is expected to complete this project during the season of 1917. Amount expended to June 30, 1916, \$4,205.76.

ELEVENTH DISTRICT.

Detroit River, Mich.—The act of March 4, 1911, appropriated \$210,000 for establishing aids to navigation along the Livingstone Channel, Detroit River, Mich., including authority to locate and construct lights and to place buoys necessary to properly mark this channel. On June 30, 1916, 12 concrete piers had been completed, and 9 placed in commission. The other 3 await the completion of contemplated changes in the channel before they can be utilized. Thirteen gas buoys and 21 spar buoys are now used to mark the channel in addition to the lights on piers. During the fiscal year, one pier light was placed in commission, being made possible by dredging operations completed by the War Department; and in addition to the lights along the channel proper, a semaphore system for controlling the movements of vessels through the channel was constructed and placed in operation. Plans have been prepared for the construction of a light and fog signal at the south end of the channel. Two additional pier lights will be established, taking the place of two gas buoys now maintained, so soon as the proposed widening of the channel shall have been completed. The date of completion depends to some extent on the completion of channel improvements now in progress. Amount expended to June 30, 1916, \$144,203.83.

TWELFTH DISTRICT.

Manistique, Mich.—The act of October 22, 1913, appropriated \$20,000 for aids to navigation, Manistique, Mich. Site was purchased and title vested in the United States. A duplex dwelling for two keepers has been completed; the steel tower on east breakwater has been erected on concrete foundation; all interior walls and reinforced concrete floors have been completed; the fog-signal machinery and illuminating apparatus are now being installed, and both the light and fog signal will be put into commission during the season of 1916. The installation of a fixed white post lantern on Manistique West Pierhead was completed and light placed in commission October 30, 1914. The installation of a 25-foot steel tower and flashing acetylene equipment on Manistique West Breakwater was completed and light placed in commission October 30, 1914. Amount expended to June 30, 1916, \$18,727.33.

White Shoal, Mich.—The act of March 4, 1907, appropriated \$250,000 for a light and fog-signal station at White Shoal, north end of Lake Michigan, to replace the White Shoal Light Vessel, which was then located over these dangerous shoals. The light was placed in commission on September 1, 1910, and the fog signal on September 15, 1910. A submarine bell was established September 20, 1911. A water-supply system was installed in October, 1911. An oil-storage system was installed during June, 1913. An auxiliary flashing acetylene winter light was installed during December, 1914, to serve as an aid to mariners between time station is closed and actual close of navigation. The equipment of the three boat cranes with air drive is still under consideration and will be completed as soon as practicable. Amount expended to June 30, 1916, \$225,181.57.

SIXTEENTH DISTRICT.

Cape St. Elias Light and Fog-Signal Station.—The act of October 22, 1913, appropriated \$115,000 for a light and fog signal to be established at or near Cape St. Elias, Alaska. The site was selected on the south end of Kayak Island and actual construction began June 1, 1915. Operations were suspended October 7, 1915, for the winter and the station left in charge of two caretakers. Work was resumed April 17, 1916. A radio outfit was established at this station in May, 1916, to facilitate supervision and

BALANCES OF SPECIAL APPROPRIATIONS CARRIED TO THE SURPLUS FUND ON JUNE 30, 1916.

The following-named balances of special appropriations under the Lighthouse Service remaining on the books of the Treasury Department, and relating to works which had been completed and against which no obligations were known to exist were carried to the surplus fund on June 30, 1916:

Light keepers' dwellings.....	\$2. 22
Point Judith Breakwater Lights, R. I.....	71. 46
Stonington Light Station, Conn.....	. 63
Staten Island lighthouse depot, N. Y.....	454. 28
Repairs to lighthouse tender Pansy.....	1, 131. 38
Miah Maull Shoal Light Station, Delaware River.....	897. 52
Chesapeake Bay lighted buoys.....	163. 73
Tender for inspector, eighth lighthouse district.....	3, 437. 36
San Juan lighthouse depot, P. R.....	. 60
Point Abino Light Vessel, Lake Erie.....	1, 197. 32
Buffalo Breakwater North End Light Station, N. Y.....	26. 04
Oconto Harbor lights, Wis.....	315. 65
Kauai Island Light Station, Hawaii.....	31. 18
Total carried to surplus fund.....	7, 729. 37

SAVING OF LIFE AND PROPERTY BY VESSELS OR EMPLOYEES OF THE LIGHTHOUSE SERVICE DURING THE FISCAL YEAR 1916.

District.	Vessel or employee rendering service.	Vessel, etc., aided.	Nature of assistance.
1st.....	C. H. Newman, keeper, Pumpkin Island Light Station, Me.	Motor boat.....	Towed to port disabled motor boat with 2 men on board. Boat leaking badly.
	E. T. Holbrook, keeper, Isle au Haut Light Station, Me.	.....do.....	Towed to harbor disabled motor boat with 4 men on board.
	.....do.....	.....do.....	Towed to station disabled motor boat with 5 men on board. Furnished men with food and shelter.
	J. H. Peasley, keeper, Crabtree Ledge Light Station, Me.	.....do.....	Towed disabled motor boat with 1 person on board to shore.
	H. G. Sawyer, keeper, Bear Island Light Station, Me.	.....do.....	Towed disabled motor boat with 1 man on board distance of 3 miles to harbor.
	Tender Hibiscus.....	Schooner Hilda Emma.	Prevented schooner, which had parted anchor chains, with no one on board, from going on rocks in Moosabec Reach and probably becoming total loss.
	C. F. Chester, keeper, Owlshead Light Station, Me.	Power launch.....	Assisted 2 fishermen whose launch struck ledge and was in sinking condition. Furnished them food, shelter, and dry clothing.
	J. W. Haley, keeper, Perkins Island Light Station, Me.	Row boat.....	Prevented waterlogged row boat, loaded with lumber and with man on board, from capsizing; lumber saved.
	.....do.....	.....do.....	Furnished party which had taken refuge on island during heavy thunderstorm with dry clothing and shelter.
	J. E. Purington, keeper, Nash Island Light Station, Me.	Schooner Maine.....	Towed schooner, which had lost her foremast in squall, 3 miles with station boat.
	Tender Hibiscus.....	Cunard liner Armonia.	Recovered anchor and 90 fathoms chain lost off Portland Light Vessel.
	F. O. Hilt, second assistant keeper, Matinicus Rock Light Station, Me.	.....do.....	Endeavored to save man who fell overboard while hauling nets. Recovered body.
2d.....	H. C. Towle, keeper, The Graves Light Station, Mass.	Motor boat.....	Towed motor boat, with 2 men aboard, in heavy sea, to safe anchorage; repaired boat and furnished men food and shelter.
	E. C. Hadley, keeper, Bakers Island Light Station, Mass.	Power boat, William B. Durand owner.	Rescued sinking power boat, made repairs, and delivered to owner.

SAVING OF LIFE AND PROPERTY BY VESSELS OR EMPLOYEES OF THE LIGHTHOUSE SERVICE DURING THE FISCAL YEAR 1916—Continued.

District.	Vessel or employee rendering service.	Vessel, etc., aided.	Nature of assistance.
2d (con)...	E. C. Mott, assistant keeper, Deer Island Light Station, Mass.	Power boat Alice, John McBride owner.	Towed disabled boat to station; fed and lodged 11 men.
	M. N. Huse, keeper, Narrows Light Station, Mass.	Launch Nautilus, George H. Walker owner.	Prevented launch, grounded on Lovells Island, from capsizing.
	A. A. Howard, keeper, Stage Harbor Light Station, Mass.	Catboat Trilby, Ernest W. Chaplin owner.	Towed catboat in distress to anchorage in harbor.
	J. E. H. Cook, keeper, Cape Ann Light Station, Mass.	Power boat, F. H. Gile owner.	Towed disabled power boat to Rockport.
	J. B. McCabe, keeper, and F. C. Mott, assistant keeper, Deer Island Light Station, Mass.	Power boat Madeleine, Richard Brown owner.	Towed disabled motor boat, with 4 men on board, to safe anchorage.
	M. N. Huse, keeper, Narrows Light Station, Mass.	Motor boat.....	Rendered assistance to motor boat with 3 persons on board.
	H. M. Bailey, first assistant keeper; C. R. Albrecht, second assistant keeper; Minots Ledge Light Station, Mass.	.....do.....	Rendered assistance to motor boat disabled in breakers. Kept boat afloat until coast guards arrived.
	L. S. Clark, keeper, Cuttyhunk Light Station, Mass.	Schooner Childe Harold.	Prevented vessel from being driven farther on shoal by informing master of his position.
	Tender Azalea.....	Tug Saddle Ross, with barge Sharon in tow.	Towed disabled tug, with barge in tow, to dock.
	A. F. Snow, master, Great Round Shoal Light Vessel No. 86, Mass.	U. S. S. San Francisco.	Rendered assistance to officer and 8 men adrift from stranded ship. Supplied clothing, food, and shelter.
3d.....	Tender Daisy.....	Power boat Grit.....	Towed stranded and abandoned power boat to boat club.
	Tender Gardenia.....	James Hownes.....	Rescued from drowning in Hudson River.
	J. Murdock, keeper, Rondout Light Station, N. Y.	Motor boat Natalie, John H. Flannery owner.	Rendered assistance to disabled motor boat.
	Tender Daisy.....	Power boat Porto...	Towed power boat, adrift on Lake Champlain, with 6 people on board, 5 miles to Plattsburgh.
	Tender Larkspur.....	Yacht Onward III. J. A. Still owner.	Towed yacht, in distress, into harbor.
	Tender Gardenia.....	Schooner Highland..	Towed schooner, in danger of sinking, near Fort Wadsworth, New York Bay, and beached in safety.
	W. F. Rhodes, keeper, Romer Shoal Light Station, N. Y.	Thomas F. Leland and James Heavy, of Staten Island.	Rescued men, whose boat had capsized, and supplied with clothing, food, and lodging; boat recovered.
	C. R. Riley, keeper, Stamford Harbor Light Station, Conn.	British schooner W. N. Zuricker, Capt. J. L. Priblicover.	Rendered assistance to vessel ashore near Stamford Harbor.
	G. L. Hoxsie, keeper, Castle Hill Light Station, R. I.	Launch, Thomas Shea, harbor master, Newport, R. I., owner.	Towed disabled launch to Newport.
	F. A. Jordan, sr., keeper, Penfield Reef Light Station, Conn.	Auxiliary sloop Amelia.	Assisted in floating vessel aground on reef.
	J. R. Carlsson, keeper, Bergen Point Light Station, N. J.	Bergen Point Light Station, N. J.	Saved light station from fire caused by burning oil cans and oil barge.
	E. A. Ottenburgh, keeper, Whitehall Narrows Lights Nos. 8, 10, and 12, N. Y.	.....	Rescued 2 men from drowning while attending lights.
	E. M. Grant, keeper, Stepping Stones Light Station, N. Y.	Power boat Helen...	Towed disabled boat to Low Narrows.
	.....do.....	Power boat.....	Towed disabled power boat to station, furnished men with lodging and food; repaired engine.
	J. Carlson, master, and August Nelsson, seaman, Ram Island Reef Light Vessel, N. J.	.....do.....	Towed disabled boat, containing 3 persons, to Noank, Conn.
4th.....	A. Johnson, keeper, Ship John Shoal Light Station, N. J.	.....do.....	Rescued disabled and leaking launch and with difficulty towed it to safe anchorage. Service resulted in probable saving from drowning of occupant.

SAVING OF LIFE AND PROPERTY BY VESSELS OR EMPLOYEES OF THE LIGHTHOUSE SERVICE DURING THE FISCAL YEAR 1916—Continued.

District.	Vessel or employee rendering service.	Vessel, etc., aided.	Nature of assistance.
4th (con.)	C. E. Rickards, first assistant keeper, and C. H. Hickman, second assistant keeper, Harbor of Refuge Light Station, Del.	Power boat of torpedo boat No. 61.	Towed disabled launch with 9 men aboard to torpedo boat; was drifting out to sea.
	M. A. Duffield, keeper, Deepwater Point Range Rear Light Station, N. J.	.....	Gave shelter, quilts, and blankets to employees of Du Pont Powder Works, burned in an explosion.
	W. Spear, keeper, Deepwater Point Range Front Light Station, N. J.	.....	Transported boy with fractured arm to hospital at Wilmington, Del., for treatment.
	S. Tessadri, second assistant keeper, Fourteen-Foot Bank Light Station, Del.	Gasoline yacht Lillian V.	Cared for crew of launch, which broke shaft in vicinity of station.
	G. A. Holston, laborer in charge, Lewes Lighthouse Depot, Del.	Motor boat.....	Towed disabled launch, with party of fishermen, drifting to sea, into Delaware Breakwater.
	W. Spear, keeper, Deepwater Point Range Front Light Station, N. J.	Motor launch Montie, of Camden, N. J.	Towed disabled launch in heavy squall, containing 4 persons, into Salem Canal.
5th.....	J. T. Shipp, keeper, Neuse River Light Station and Point of Marsh Light, N. C.	Motor boat Clara S., Capt. E. B. Pobst.	Assisted occupants after motor boat became disabled.
	A. J. English, keeper, Harbor Island Bar Light Station, N. C.	Schooner M. L. Davis, Isaac Davis, owner.	Floated loaded schooner, grounded on Harbor Island Bar, N. C.
	J. T. Shipp, keeper, Neuse River Light Station and Point of Marsh Light, N. C.	Launch Susie Swindell.	Assisted several men and children in disabled launch.
	T. D. Quidley, assistant keeper, Neuse River Light Station and Point of Marsh Light, N. C.	Gas freight boat Nelson, Capt. Murray Nason owner.	Rendered assistance to disabled boat.
	I. C. Meekins, assistant keeper, Croatan Light Station, etc., N. C.	Peter G. Gallop, keeper, Croatan Light Station, etc., N. C.	Rescued keeper from drowning.
	Tender Jessamine.....	Schooner James H. Hargraves.	Towed derelict from mid-channel to Cornfield Harbor, Md.
	W. G. Rollinson, keeper, Hatteras Inlet Light Station, N. C.	Fishing boats.....	Rendered assistance to boats in distress, each having 1 man aboard.
	W. J. Tate, keeper, North Landing River, etc., Aids, N. C.	Tug Adelaide, Capt. William Bonsal.	Floated tug, grounded near Long Point, N. C. Furnished water and provisions.
	Tender Laurel.....	Sloop Silver Spray, Capt. T. J. Williams.	Towed disabled sloop to harbor.
	W. G. Rollinson, keeper, Hatteras Inlet Light Station, N. C.	Steamship N. G. Walestein, George K. Rollinson owner.	Pulled disabled steamship off Hatteras Reefs, towed to harbor and landed passengers.
	Tender Maple.....	Schooner Lina James	Pulled schooner clear of ice into free water.
	Tender Holly.....	Schooner D. J. Whealton.	Floated schooner which had gone ashore on Kennons Flats, James River, Va.
	J. T. Shipp, keeper, Neuse River Light Station, etc., N. C.	Motor boat, G. G. Paul, Bayboro, N. C., owner.	Rendered assistance to disabled motor boat and furnished occupant with food.
	W. H. Davis, jr., keeper, Lazaretto Lighthouse Depot, Md.	.....	Attempted to rescue drowning man.
	H. C. Wingate, watchman, Lazaretto Lighthouse Depot, Md.	.....	Do.
	W. J. Tate, keeper, North Landing River, etc., Aids, N. C.	Gasoline freighter, Gratitude.	Assisted in floating freighter.
	Do.....	.....	Saved raft from stranding.
	S. R. Van Houter, keeper, Thomas Point Shoal Light Station, Md.	Gasoline launch, Rex, John D. Johnson, Baltimore, Md., owner.	Rendered assistance to disabled launch.
	O. P. Olsen, assistant keeper, Baltimore Light Station, Md.	Yacht Lola.....	Rendered assistance to yacht, which had run ashore.
6th.....	J. Lindquist, keeper, and W. Lindquist, assistant keeper, Mosquito Inlet Light Station, Fla.	Yacht Mana.....	Assisted in pulling yacht off shoal.
	C. P. Honeywell, keeper, Cape Canaveral Light Station, Fla.	Yacht Viola II of Philadelphia, Pa., Marshal Jones, jr., owner.	Assisted in repairing yacht in distress.

SAVING OF LIFE AND PROPERTY BY VESSELS OR EMPLOYEES OF THE LIGHTHOUSE SERVICE DURING THE FISCAL YEAR 1916—Continued.

District.	Vessel or employee rendering service.	Vessel, etc., aided.	Nature of assistance.
6th (con.)	H. S. Svendsen, keeper, South Channel Range Lights, S. C.	War Department launch No. 12.	Towed disabled launch in Charleston Harbor to wharf at Fort Moultrie.
	I. Larsen, depot keeper, Castle Pinckney, S. C.	Launch.....	Assisted in mooring launch, grounded near depot, in safe place and transported crew to Charleston.
	C. Seabrook, second assistant keeper, Cape Romain Light Station, S. C.	Schooner Luther F. Garrison.	Transported captain and seven of crew who had landed on beach to station; furnished food and clothing.
	Tender Mangrove.....	U. S. S. K-5.....	Searched for U. S. S. K-5 when communication with vessel was lost.
	.....do.....	.....	Rescued man in drifting boat outside Port Royal Sound, S. C., put him ashore and boat in safe anchorage.
	Tender Cypress.....	Tug Henry Buck of Charleston, S. C.	Assisted in extinguishing fire.
	L. H. Bringloe, keeper, Charleston Light Station.	.....	Found body of man washed ashore on Morris Island. Reported to coroner.
	A. A. Burn, first assistant keeper, Tybee Range Front, etc., Lights, Ga.	Small boat.....	Rescued three soldiers from Fort Screven, Ga., adrift in a small boat.
	H. S. Svendsen, keeper, South Channel Range Lights, S. C.	U. S. Navy launch..	Pulled navy yard launch off bank in Sullivan's Island Cove.
7th.....	Tender Arbutus.....	Power yacht Bon Temps.	Towed disabled and sinking yacht to safe anchorage, and furnished food and quarters to ten persons.
8th.....	W. B. Thompson, keeper, C. C. Sapp, assistant keeper, Sabine Pass Light Station, Tex.	.....	Maintained characteristic of light by hand during hurricane.
	A. B. Modawell, keeper, J. Brew, first assistant keeper, J. W. Gauthier, second assistant keeper, U. M. Gunn, third assistant keeper, Sabine Bank Light Station, Tex.	.....	Maintained light during hurricane.
	H. C. Claiborne, keeper, J. P. Brooks, first assistant keeper, C. T. Morris, second assistant keeper, Bolivar Point Light Station, Tex.	.....	Maintained characteristic of light by hand during hurricane.
	G. R. Smith, keeper, L. R. Smith, assistant keeper, Red Fish Bar Cut Light Station, Tex.	.....	Maintained light during hurricane.
	S. Gibbon, keeper, J. D. Balsillie, assistant keeper, Brazos River Light Station, Tex.	.....	Maintained light during hurricane by hand.
	W. Hill, keeper, Calcasieu Range Light Station, La.	.....	Maintained light and made effort to save Government property during hurricane.
	E. Danley, keeper, Pascagoula River Entrance Lights, Miss.	.....	Displayed energy in making repairs and recovering Government property during hurricane.
	F. A. Schrieber, keeper, Lake Borgne Light Station, Miss.	.....	Maintained light under trying conditions during hurricane.
	F. H. Johnstons, foreman eighth district.	.....	Maintained light and made temporary repairs, replacing storm panes destroyed in hurricane.
	T. Zettwoch, keeper, West Riglets Light Station, La.	.....	Maintained light under trying conditions during hurricane.
	C. Riddle, keeper, New Canal Light Station, La.	.....	Do.
	J. P. Groux, keeper, Chefunte River Light Station, La.	.....	Do.
	H. A. Succow, keeper; J. W. Shapr, assistant keeper; Pass Manchac Light Station, La.	.....	Do.
	W. W. Bayly, keeper; M. Durabb, first assistant keeper; J. C. Welch, second assistant keeper, Chande- leur Light Station, La.	.....	Do.
	A. Rodi, keeper; S. Coludrovitch, assistant keeper, South Pass East Jetty Light Station, etc., La.	.....	Do.

SAVING OF LIFE AND PROPERTY BY VESSELS OR EMPLOYEES OF THE LIGHTHOUSE SERVICE DURING THE FISCAL YEAR 1916—Continued.

District.	Vessel or employee rendering service.	Vessel, etc., aided.	Nature of assistance.
8th (con.).	C. W. Heartt, keeper, Cubits Gap Light Station, La.	.....	Maintained light under trying conditions during hurricane.
	J. W. St. G. Gibbon, keeper; C. T. Thomassen, assistant keeper, Head of Passes Light Station, etc., La.	.....	Do.
	E. Grandison, laborer in charge, Ironton Light, La.	.....	Constructed temporary beacon and exhibited the light during hurricane.
	Miss A. Meyer, laborer in charge, Shingle Point Post, La.	.....	Exhibited light from tree in vicinity of destroyed beacon during hurricane.
	R. G. Miller, keeper, Barataria Bay Light Station, La.	.....	Maintained light under trying conditions during hurricane.
	J. C. Gray, keeper; J. P. Anderson, assistant keeper, Timbalier Light Station, La.	.....	Do.
	J. McNamara, keeper; W. H. Oliver, first assistant keeper; F. J. Le Bouf, second assistant keeper; E. F. Burke, third assistant keeper, Ship Shoal Light Station, La.	.....	Do.
	H. A. Burns, cadet officer, O. Olsen, machinist, tender Sunflower.	Maartensdijk, Texas Transport & Terminal Co., agents, New Orleans, La.	Rendered service in diving to unwind the hawser of S. S. Maartensdijk, entangled in propeller of the tender Sunflower while assisting disabled steamship.
	J. W. St. G. Gibbon, keeper; C. T. Thomassen, assistant keeper, Head of Passes Light Station, La.	Gasoline launch; owner unknown.	Brought man and boy to station and furnished them food and gasoline.
	J. Asplund, keeper; E. T. Erickson, first assistant keeper, Galveston Harbor Light Station, Tex.	Launch; owner unknown.	Towed disabled launch for distance of about 9 miles to Galveston, Tex.
	Tender Sunflower.....	S. S. Turrialba; United Fruit Co., New Orleans, La., owners.	Assisted in floating vessel ashore in South Pass of the Mississippi River.
	.....do.....	Lighter, U. S. Engineer Department, New Orleans, La.	Attempted to pull lighter off west bank of Mississippi River in vicinity of Head of the Passes.
	Tender Camellia.....	Launch Oralie; owner unknown.	Towed disabled launch to Lake Borgne, La.
	.....do.....	Launch Simon; owners unknown.	Towed launch containing 8 persons to wharf at Galveston, Tex.
	F. S. Schrieber, assistant keeper, Round Island Light Station, Miss., and N. Nilsen, keeper, Pascagoula River Range Lights, Miss.	Schooner Henry M; owners unknown.	Furnished crew with clothing and food and towed schooner to place of safety.
10th.....	M. McCluskey, J. Christiansen, and S. Greve, seamen, Southwest Pass Light Vessel 43, La.	Southwest Pass Light Vessel 43, La.	Rendered service under hazardous and trying conditions during hurricane.
	J. Safe, assistant keeper, South Buffalo Light Station, N. Y.	Airship.....	Assisted 2 men who, with disabled airship, had dropped into the water.
	C. Fitzmorris, keeper, West Sister Island Light Station, Ohio.	Yacht Dorothy E...	Assisted owners in getting proper anchorage near light station during gale.
	.....do.....	Yacht Argument...	Assisted crew when yacht was driven ashore on island.
11th.....	S. Shaw, Jr., keeper, Presque Isle Light Station, Pa.	Tug Henry E. Gillen.	Endeavored to obtain assistance for tug which stranded on bar, and cared for articles washed ashore.
	Tender Clover.....	Launch Hoodoo, Wm. Bousho owner.	Rescued disabled launch containing 5 persons.
	P. H. Garraty, keeper; G. J. Hassett, first assistant keeper; and A. Brock, second assistant keeper, Middle Island Light Station, Mich.	Yacht Irvington, E. M. Haywood owner.	Removed women passengers from vessel aground.
	W. G. Marshall, keeper; F. McFall, assistant keeper, Windmill Point Light Station, Mich.	Motorboat.....	Towed disabled motor boat to safety.

SAVING OF LIFE AND PROPERTY BY VESSELS OR EMPLOYEES OF THE LIGHTHOUSE SERVICE DURING THE FISCAL YEAR 1916—Continued.

District.	Vessel or employee rendering service.	Vessel, etc., aided.	Nature of assistance.
11th (con.)	E. Van Natta, keeper, Grassy Island South Channel Range Light Station, and H. W. Noel, keeper, Grassy Island North Channel Range Light Station, Mich.	Motor boat, L. Cuneaz owner.	Towed disabled launch with 8 passengers aboard to shore.
	E. Van Natta, keeper, Grassy Island South Channel Range Light Station, Mich.	Small scow.....	Towed small scow beyond control with 4 boys aboard, to safety.
	T. E. Dee, keeper; E. Byrne, first assistant keeper; W. S. Hall, second assistant keeper, Point Iroquois Light Station, Mich.	Motor boat Leora, John Bourne owner.	Rescued disabled motor boat in sinking condition.
	T. E. Radcliff, second assistant keeper, Tawas Light Station, Mich.	Rowboat.....	Rescued rowboat adrift with 2 boys aboard.
	F. G. Sommer, keeper, and A. Hetu, first assistant keeper, Detour Light Station, Mich.	Tug Gazelle.....	Brought members of crew of disabled vessel ashore for purpose of making repairs.
12th.....	C. A. Stram, keeper; M. Weiss, assistant keeper, Cana Island Light Station, Wis.	Motor boat Martha S., Oconto, Wis.	Pulled boat, which had run on rocks, out of danger.
	A. C. Erickson, keeper, Little Traverse Light Station, Mich.	Launch.....	Towed disabled launch with 1 occupant into harbor.
	O. C. McCauley, keeper, Squaw Island Light Station, Mich.	Fish tug Two Sisters, St. James, Mich.	Rendered assistance to disabled tug.
	A. C. Mann, second assistant keeper, Calumet Harbor Light Station, Ill.	Son of H. Wentworth, 1600 South Dearborn St., Chicago, Ill.	Rescued from drowning.
	F. A. Drew, keeper, Green Island Light Station, Wis.	Gasoline steamer Starlight, of Marinette, Wis.	Assisted in getting stranded steamer off reef.
	W. Ottosen, keeper; R. G. Petersen, second assistant keeper, Pilot Island Light Station, Wis.	Motor boat.....	Towed disabled motor boat with 3 occupants out of danger and repaired engine.
	S. M. Danielsen, keeper, Chicago Harbor Light Station, Ill.	.....	Rescued 5 men marooned on breakwater during storm and took them to safe landing.
	T. Robinson, keeper; J. Erikson, first assistant keeper; J. Edlund, second assistant keeper, Muskegon Pierhead Range Light Station, Mich.	Summer cottages....	Assisted in preventing more serious fire loss to summer-resort cottages near station.
	C. S. Grenell, keeper, Chicago Pierhead Range Light Station, Ill.	.....	Rescued from drowning man who had fallen off pier.
	C. E. Corlett, master; A. Wanke, engineer, Light Vessel No. 56.	Motor fish boat Why-not.	Towed motor boat to light vessel.
	J. J. Rollefson, keeper; E. R. Ledwell, assistant keeper, Chambers Island Light Station, Wis.	Motor boat Starlight, Marinette, Wis.	Gave food and clothing to 3 shipwrecked sailors whose motor boat was destroyed by fire, and took men over to Marinette, Wis.
	R. W. Johnson, keeper; M. Telford, first assistant keeper, North Manitou Island Light Station, Mich.	Motor boat Alice L..	Assisted in hauling disabled motor boat, put on beach, and relaunching after rudder had been repaired.
	.....do.....	Motor fish boat Why-not.	Assisted in rescuing motor boat.
	O. C. McCauley, keeper, Squaw Island Light Station, Mich.	Fish launch Rosa B..	Towed disabled launch to Beaver Harbor, Mich.
	J. Kilgore, keeper, Grand Haven Pierhead Range Light Station, Mich.	.....	Rescued 2 men of U. S. Coast Guard in danger of being carried into Lake Michigan by ice.
	T. J. Armstrong, keeper, Michigan City East Pierhead Light Station, Ind.	.....	Rescued 2 men from drowning.
	T. J. Armstrong, keeper; F. Dykeman, second assistant keeper, Michigan City East Pierhead Light Station, Ind.; and J. E. Muckian, assistant keeper, Calumet Pierhead Light Station, Ill.	Fish tug Eagle.....	Assisted in releasing vessel from ice.
	J. M. Robinson, keeper; H. Osby, first assistant keeper; A. G. Fichtner, second assistant keeper, Calumet Harbor Light Station, Ill.	Motor launch Mary Lee, A. G. Brandesburg, 6117 Greenwood Ave., Chicago, Ill., owner.	Rescued disabled motor launch in danger of being crushed against pier.

SAVING OF LIFE AND PROPERTY BY VESSELS OR EMPLOYEES OF THE LIGHTHOUSE SERVICE DURING THE FISCAL YEAR 1916—Continued.

District.	Vessel or employee rendering service.	Vessel, etc., aided.	Nature of assistance.
12th (con.)	Tender Sumac.....	Steamer Hennepin, Capt. J. A. Braunnell, Lake Shore Steamer Co., First National Bank Building, Milwaukee.	Worked off vessel aground in White Lake, Mich., into deep water.
	Tender Hyacinth.....	Steamer German....	Worked off vessel ashore on shoal off Rowley Bay, Wis., into deep water.
	J. McCormick, keeper, and assistant keeper, South Fox Island Light Station, Mich.	Motor boat.....	Pulled off disabled boat containing 3 men, ashore on Fox Island, and towed her to fish tug.
16th.....	Tender Kukul.....	Gasoline schooner Favorite of Cordova, Bing Halleck captain and owner.	Rescued captain, engineer, and one other person from shipwrecked schooner.
	Tender Fern.....	Small gasoline boat, William Bowers owner.	Towed disabled boat and owner, suffering from blood poisoning in arm, to Petersburg, Alaska.
	Tender Kukul.....	Three-masted schooner P. J. Adler, J. E. Shields owner.	Rendered assistance and beached vessel, which was afire.
	.....do.....		Searched for party of 3 men and gas boat Francis R., employed by Bureau of Fisheries.
	Geo. A. Lee, keeper, Tree Point Light Station, Alaska.	Launch Violet, Johnson Russ owner.	Furnished gasoline.
	N. S. Douglas, keeper; S. L. Atkinson, assistant keeper, Lincoln Rock Light Station.	Launch from U. S. S. Patterson.	Furnished food to occupants.
	S. A. Ellings, first officer, tender Fern.	Thomas G. Neile....	Rescued demented man, who had plunged overboard, from attempted suicide.
17th.....	Relief Light Vessel No. 92.....	Motor fishing boat...	Rescued 2 men from disabled boat and kept them on board over night.
	H. P. Score, keeper, Slip Point Light Station, Wash., with assistance of son, Walter.	Motor boat Bunch, Hugh Wickersham in charge.	Rescued disabled boat from dangerous position and towed to safe anchorage.
	L. A. Petterson, keeper, West Point Light Station, Wash.	Small sailboat, Harry Christensen owner.	Rescued man from drowning whose boat had capsized; furnished dry clothing.
	W. S. Denning, keeper; S. B. Morris, assistant keeper, Robinson Point Light Station, Wash.	Motor boat.....	Rescued man, wife, and 2 small children from disabled boat near station; furnished food and clothing.
18th.....	J. A. Picone, launchman; G. T. Olson, keeper; P. Chekles, first assistant keeper; and L. G. McKay, second assistant keeper, Mile Rocks Light Station, Cal.	.....	Rescued from drowning man fallen or jumped overboard from passing steamer.
	L. R. Willard, assistant keeper, Oakland Harbor Light Station, Cal.	Drowning man.....	Rescued fisherman from drowning by capsizing of boat.
	Tender Madrono.....	Navy tug Vigilant..	Towed disabled tug from city front to Goat Island Wharf.
	Light Vessel No. 83, Cal.....	Steamer Bear.....	Cared for 160 passengers and crew of wrecked steamer Bear; supplied dry clothing and provisions.
	W. M. Greene, second assistant keeper, San Luis Obispo Light Station, Cal.	Small boat from S. S. Roanoke.	Sighted and assisted in bringing in boat from S. S. Roanoke; 5 dead and 3 nearly unconscious.
	R. H. Williams, keeper, Point Arena Light Station, Cal.	Gasoline schooner Alliance No. 2.	Sighted disabled launch near breakers; notified Coast Guard crew; 1 man rescued.
19th.....	Tender Columbine.....	Bark British Yeoman.	Saved vessel and all on board from almost certain destruction through heroic efforts of officers and crew of Columbine, during progress of a gale off Port Allen, Hawaii.
	.....do.....	Steamer Mikahala...	Pulled grounded vessel off reef on exposed shore of Molokai.

DAMAGE BY COLLISIONS.

The following is a list of the more important collisions affecting the property of the Lighthouse Service which occurred during the fiscal year 1916:

On August 1, 1915 Georges Island Rocks Gas Buoy, 5, Mass., was fouled by the S. S. *City of Atlanta*. Cost of repairs in the sum of \$11.90 was paid by the owners of the vessel.

On August 23, 1915, Shovelful Shoal Light Vessel No. 3, Mass., was fouled by the U. S. S. *Beale*, damaging it to the extent of \$247. Repairs have been made by the Government.

On August 29, 1915, Cross Rip Light Vessel No. 5, Mass., was fouled by the schooner *Frances Goodnow*. Repairs costing \$384 were paid for by the owners of the schooner.

On December 7, 1915, Canal Channel Light No. 11, Mass., was fouled by barges in tow of the tug *Confidence*. Expense of rebuilding the light in the sum of \$230 was paid by the lessee of the tug.

On January 5, 1916, Canal Channel Light No. 10, Mass., was fouled by barges in tow of the tug *Confidence*. The cost of replacing the light in the sum of \$590.10 was paid by the lessee of the tug.

On September 28, 1915, Boston Light Vessel No. 54, Mass., was fouled by the S. S. *Quantico*, causing damages to the extent of \$1,286.75, which amount was paid by the owners of the vessel.

On or about July 26, 1915, Junction Light, Newark Bay, N. J., was damaged beyond repair by an unknown vessel. The structure will be rebuilt by the Government.

On May 8, 1916, Fire Island Light Vessel No. 68, N. Y., was collided with by the British steamship *Philadelphian*, inflicting damages estimated at over \$9,000. The expense of the repairs to the light vessel will be borne by the owners of the steamship.

On March 1, 1916, Fire Island Light Vessel No. 68, N. Y., was collided with by the British steamship *Eastern City*, inflicting damages to the light vessel, a whaleboat and 16-foot dory in the estimated amount of \$949. Steps have been taken to have the owners of the steamship bear the expense of repairs.

On February 24, 1916, Overfalls Light Vessel No. 69, while lying at dock at the general lighthouse depot, Tompkinsville, N. Y., was collided with by a barge, causing damages estimated at \$245.15. Steps have been taken to have the damage paid for by the owners or charterers of the barge.

On October 14, 1915, the tug *Storm King* fouled Beaufort Harbor Entrance Bell Buoy, 1, N. C. The cost of recovering the buoy, \$25, was paid by the owners of the tug.

On September 20, 1915, the tender *Holly*, while lying at Portsmouth lighthouse depot, Va., was struck by the S. S. *Santa Clara*, inflicting damages in the estimated amount of \$154.50, which was paid by the Government.

On November 2, 1915, Elizabeth River Gas Buoy, 7A, Va., was collided with by the S. S. *Alfred Nobel*. Cost of repairs to the lantern of the buoy, \$191.09, was paid by the agents for the steamer.

On January 19, 1916, Craighill Channel Range Front Light Station, Md., was collided with by two barges in tow of the tug *J. H. Riehl*. Damage to the light station in the amount of about \$230 will be paid for by the owners of the tug.

On March 7, 1916, Windmill Point Shoal Light, N. C., was collided with by a raft in tow of the gasoline boat *Eloise*, inflicting damages in the amount of about \$130. The claim was compromised.

On March 11, 1916, Parrot Island Light, Va., was collided with by the S. S. *Potomac*. Repairs costing about \$120 will be made by the owners of the steamer.

On May 20, 1916, one of two barges in tow of the tug *Sarah* was in collision with Croatan Light Station, N. C., smashing the station boat. Efforts are being made to have the owners of the tug assume the cost of the damage, estimated at \$150.

On June 14 or 15, 1916, the tug *Corinthia* collided with Morehead City Channel Light, N. C. The owners of the tug have arranged to pay for the damage, amounting to about \$125.

On April 29, 1916, Southwest Channel Entrance Buoy, PS, Tortugas Harbor, Fla., was fouled and sunk by barge *Conemaugh* in tow by steamer *Gulfoil*. Efforts are being made to have the owners of the vessel pay for the amount of the damages, estimated at \$288.

On September 28, 1915, Mobile Ship Channel Light No. 6A, Ala., was collided with by the S. S. *Alm*. The cost of repairs, \$406.95 was assumed by the steamship company's agent.

On December 3, 1915, Mobile Ship Channel Light No. 10A, Ala., was collided with and destroyed by a motor barge. Cost of repairs amounting to \$625.09 was assumed by the owners of the barge.

On March 29, 1916, Round Island South Spit Light, Miss., was collided with and destroyed by the tug *Catherine*. Cost of repairs amounting to \$1,184.49 was assumed by the owners of the tug.

On February 18, 1916, the S. S. *Carolina* fouled and carried away Tablazo Shoal Buoy No. 12, San Juan Harbor, P. R. The owners of the steamer have agreed to replace the buoy and its appendages, valued at \$157.10.

On May 23, 1916, the lighthouse tender *Crocus*, while tied up at the Lighthouse depot dock, Buffalo, N. Y., was struck by a dump scow in tow of the tug *Alva B*. The estimated damage, which the owners of the tug are taking steps to have repaired, is \$100.

On August 27, 1915, the steamer *Thomas Lynch* collided with Duluth Harbor Basin Buoy, 5, Superior Bay, Minn., causing damage to the extent of \$185. The cost of repairs was paid by the owners of the steamer.

On November 8, 1915, Round Island Gas Buoy, 9, Lake Huron, Mich., was collided with and sunk by the steamer *Richard Trimble*. The replacing of the buoy at an estimated cost of \$2,130.54 has been assumed by the owners of the steamer.

On about December 3, 1915, Russell Island Shoal Gas Buoy, St. Clair River, Mich., was struck and dragged out of position by an unknown vessel. The buoy was damaged to the extent of \$118. Repairs were made at the expense of the Government. Efforts to ascertain the name of the offending vessel have been unavailing.

On October 23, 1915, the barge *Adriatic*, in tow of the tug *Smith*, collided with and completely wrecked the Kewaunee Range Rear Tower, Wis. The tower is being repaired by the owners of the barge and tug.

On May 27, 1916, the steamship *Norman B. Ream* collided with and totally destroyed Calumet Pierhead Light Station motor boat No. 15, Ill. Boat and equipment valued at \$486.73, as well as personal property, belonging to keepers, valued at \$51.05, will be replaced by the owners of the steamer.

On November 4, 1915, Hunters Bar Beacon Light structure, Columbia River, Oreg., was carried away by the S. S. *Multnomah*. The structure was replaced at a cost of \$150, which was paid by the owners of the steamer.

On December 24, 1915, San Francisco Light Vessel No. 70, while moored at Goat Island Lighthouse Depot, Cal., was run into by the naval station launch *Castro*, inflicting damages estimated at \$1,418.

The following damage was caused by vessels doing work of the Lighthouse Service during the year:

On March 9, 1916, relief light vessel No. 90, in docking at the coal wharf of Garfield & Proctor, New Bedford, Mass., collided with the wharf of the Valvoline Oil Co., damaging the wharf to the extent of \$19.23.

On March 2, 1916, the tender *Panvy* drifted into and damaged street-cleaning scow No. 49, of New York City, in the estimated amount of \$169.

On October 14, 1915, the tender *Kukui*, in docking at the Northland dock, Ketchikan, Alaska, drifted into the gas boat *Presho*, damaging it to the extent of \$37.65.

On July 24, 1915, Relief Light Vessel No. 76, Cal., in backing out from pier 15, San Francisco, collided with the steamer *George W. Elder*, damaging the steamer to the extent of \$53.39.

The Lighthouse Service was responsible for these four collisions, and in accordance with section 4 of the act approved June 17, 1910 (36 Stat., 537), estimates will be submitted to Congress in the cases of the first three mentioned collisions. In the case of the last-mentioned collision appropriation was recommended to Congress in the amount named, which appropriation was made by the act of February 28, 1916.

PUBLICATIONS OF THE LIGHTHOUSE SERVICE.

[All publications are at present distributed free.]

Publications.	Date of last edition.	Cost of last edition.	Number distributed.
Light lists:			
Atlantic and Gulf coasts of United States.....	Jan. 1, 1916	\$4,122	9,146
Pacific Coast of United States, etc.....	.....do.....	1,274	2,370
Great Lakes of United States and Canada.....	Apr. 1, 1916	1,715	2,135
Upper Mississippi River and tributaries.....	July 15, 1915	319	1,068
Ohio River and tributaries.....	Sept. 15, 1915	151	960
Lower Mississippi River and tributaries.....	Oct. 15, 1915	280	1,129

APPROPRIATIONS FOR THE BUREAU OF LIGHTHOUSES AND THE LIGHTHOUSE SERVICE, SIXTY-FOURTH CONGRESS, FIRST SESSION, 1915-16.

Title.	Act.	Amount.
Maintenance:		
Salaries, Bureau of Lighthouses, 1917.....	Legislative, May 10, 1916.....	\$64, 030
General expenses, Lighthouse Service, 1917.....	Sundry civil, July 1, 1916.....	2, 790, 000
Salaries of keepers of lighthouses, 1917.....	do.....	940, 000
Salaries, lighthouse vessels, 1917.....	do.....	1, 070, 000
Salaries, Lighthouse Service, 1917.....	do.....	375, 000
Total for maintenance.....		5, 239, 030
Special works:		
Repairing and rebuilding aids to navigation, Gulf of Mexico.....	Urgent deficiency, Feb. 28, 1916.....	200, 000
Repairing and rebuilding aids to navigation, Gulf of Mexico.....	General deficiency, Sept. 8, 1916.....	125, 000
Dog Island Light, Me.....	Sundry civil, July 1, 1916.....	3, 500
Woods Hole lighthouse depot, Mass.....	do.....	50, 000
Aids to navigation, Hudson River, N. Y.....	do.....	100, 000
Aids to navigation, Delaware River, Pa. and Del.....	do.....	80, 000
Aids to navigation, St. Johns River, Fla.....	do.....	66, 000
Aids to navigation, Florida Reef, Fla.....	do.....	75, 000
Aids to navigation, Mississippi River, La.....	do.....	50, 000
Tender and barge, eighth district.....	do.....	20, 000
Aids to navigation, Conneaut Harbor, Ohio.....	do.....	63, 500
Aids to navigation, Toledo Harbor, Ohio.....	do.....	15, 000
Aids to navigation, Fighting Island, Mich.....	do.....	25, 000
Kellett Bluff Light Station, Wash.....	do.....	40, 000
Aids to navigation, Coquille River, Oreg.....	do.....	6, 000
Point Vicente Light Station, Cal.....	do.....	80, 000
Total for special works.....		999, 000
Grand total.....		6, 238, 030

EXPENDITURES DURING THE FISCAL YEAR 1916 FROM APPROPRIATIONS FOR THE LIGHTHOUSE SERVICE.

[Obligations incurred are not included.]

MAINTENANCE APPROPRIATIONS.

Salaries:	
Bureau of Lighthouses, 1915.....	\$2, 804. 65
Bureau of Lighthouses, 1916.....	60, 605. 50
Expenses of buoyage: Certified claims.....	294. 86
Supplies of lighthouses: Certified claims.....	100. 00
Salaries of keepers of lighthouses:	
1914.....	392. 66
1915.....	29, 056. 12
1916.....	898, 430. 30
Repairs and incidental expenses of lighthouses: Certified claims.....	17. 84
Salaries, lighthouse vessels:	
1914.....	33. 33
1915.....	34, 803. 25
1916.....	950, 588. 85
Salaries, Lighthouse Service:	
1915.....	4, 798. 75
1916.....	367, 808. 46
General expenses, Lighthouse Service:	
1914.....	2, 099. 76
1915.....	438, 900. 83
1916.....	2, 211, 968. 81
Certified claims.....	2. 28
Total maintenance.....	5, 002, 706. 25

SPECIAL WORKS.

General:

Tender for first lighthouse district.....	\$90,530.36
Tender for fifteenth lighthouse district.....	9,896.17
Light vessels for general service.....	72,039.82
Lighthouse tender, general service.....	107,854.82
Oil houses for light stations.....	1,652.51
Light keepers' dwellings.....	961.37
Relief of employees of the Lighthouse Service.....	
Claims for damages by collision with lighthouse vessels.....	53.39
Second district:	
Cape Cod Canal Lights, Mass.....	21,064.33
Third district:	
Staten Island and West Bank Light Stations, N. Y.....	46.61
Staten Island lighthouse depot, N. Y. (power plant).....	90.43
Staten Island lighthouse depot, N. Y. (carpenter shop).....	10,940.19
Newark Bay beacon lights, N. J.....	3,412.95
Rondout Creek Light Station, N. Y.....	11,985.06
Point Judith Breakwater Lights, R. I.....	541.18
Stonington Light Station, Conn.....	491.64
Fifth district:	
Thimble Shoal Light Station, Va.....	529.61
Lighting Norfolk Harbor, Va.....	14,223.56
Fort McHenry Channel Range Lights, Md.....	34,975.62
Sixth district:	
Tender for engineer, sixth lighthouse district.....	211.96
Depot for sixth lighthouse district.....	59,527.63
Eighth district:	
Tender for inspector, eighth lighthouse district.....	2,647.00
Galveston Jetty Light Station, Tex.....	7,295.40
Southwest Pass Light Vessel, Mississippi River, La.....	64,103.50
Aids to navigation, Atchafalaya Entrance Channel, La.....	18,984.22
Repairing and rebuilding aids to navigation, Gulf of Mexico.....	29,298.96
Ninth district:	
Navassa Island Light Station, W. I.....	11,253.28
Tenth district:	
Point Abino Light Vessel, Lake Erie.....	8,928.45
Cleveland Fog-Signal Station, Ohio.....	12,791.57
Aids to navigation, Ashtabula Harbor, Ohio.....	20,669.42
Aids to navigation, Lorain Harbor, Ohio.....	1,879.38
Eleventh district:	
Aids to navigation, St. Marys River, Mich.....	109.91
Aids to navigation, Ashland, Wis.....	5,850.48
Detroit River lights, Mich.....	1,076.45
Superior Pierhead Range Lights, Wis.....	3,999.48
Twelfth district:	
Oconto Harbor lights, Wis.....	2,457.88
Milwaukee Light Vessel, Wis.....	852.87
White Shoal Light Station, Lake Michigan, Mich.....	2.50
Aids to navigation, Manistique, Mich.....	11,812.71
Sixteenth district:	
Aids to navigation, Alaska.....	29,117.79
Cape St. Elias Light Station, Alaska.....	66,273.79
Seventeenth district:	
Aids to navigation, Puget Sound, Wash.....	8,399.25
Total, special works.....	748,833.50
Total, maintenance appropriations.....	5,002,706.25
Total, special works.....	748,833.50
Grand total.....	5,751,539.75

ITEMIZED ESTIMATES OF APPROPRIATIONS FOR THE FISCAL YEAR 1918, AND ITEMIZED STATEMENT OF EXPENDITURES FOR THE FISCAL YEAR 1916, AS REQUIRED BY THE ACT OF CONGRESS APPROVED JUNE 25, 1910 (36 STAT., 755).

[The expenditures herein stated are in part estimated, owing to the fact that all obligations incurred for the year 1916 have not yet been settled. Articles of supplies purchased for general stock have also been distributed, approximately, to features to be benefited. This table refers to appropriations made in the sundry civil appropriation act and does not include Bureau salaries in Washington nor the cost of publications, otherwise provided for.]

Item.	Estimate, 1918.	Expenditures, 1916.	Item.	Estimate, 1918.	Expenditures, 1916.
GENERAL EXPENSES, LIGHTHOUSE SERVICE.			GENERAL EXPENSES, LIGHTHOUSE SERVICE—contd.		
Lights and fog signals:			Offices—Continued.		
Rations and provisions.....	\$163,000	\$162,031	Telegraph and telephone....	\$7,600	\$7,675
Fuel and rent for keepers...	53,000	52,299	Traveling expenses and mileage.....	39,000	38,789
General supplies.....	225,000	217,255	Rent.....	6,000	5,292
Repairs and improvements, including grounds and outbuildings.....	350,000	342,132	Freight, expressage, and cartage.....	30,000	30,165
Establishing lights and fog signals, including sites....	52,000	50,569	Motor cycle, Hawaiian Islands.....	150	
Necessary additional land for light stations.....	1,500	310	Incidental expenses.....	4,000	4,057
Oil and carbide houses.....	2,000	256	Total.....	2,850,000	2,773,500
Incidental expenses.....	8,000	8,181	Appropriation, 1917, \$2,790,000.		
Daymarks and spindles:			Appropriation, 1916, 2,775,000.		
Establishment, including sites.....	2,000	1,055	SALARIES OF KEEPERS OF LIGHTHOUSES.		
Repairs and improvements.	8,000	7,911	Salaries of lighthouse keepers.	950,000	922,233
Incidental expenses.....	250	147	Appropriation, 1917, \$940,000.		
Post lights:			Appropriation, 1916, 940,000.		
Establishment.....	6,500	5,832	SALARIES, LIGHTHOUSE VESSELS.		
Wages of laborers attending lights.....	220,000	217,454	Salaries and wages, lighthouse tenders.....	802,130	631,643
Supplies.....	18,000	17,135	Salaries and wages, light vessels.....	417,870	354,259
Repairs and improvements.	14,350	14,406	Total.....	1,220,000	985,902
Incidental expenses.....	1,000	1,364	Appropriation, 1917, \$1,070,000.		
Buoys:			Appropriation, 1916, 1,010,000.		
Establishment.....	165,000	181,955	SALARIES, LIGHTHOUSE SERVICE.		
Supplies.....	30,000	25,183	Salaries, executive and technical.....	150,600	134,544
Repairs.....	55,000	54,047	Salaries, clerical and messenger.....	144,000	133,388
Incidental expenses.....	750	802	Salaries, authorized depot force.....	100,000	103,758
Tenders:			Total.....	394,600	371,720
Rations and provisions.....	210,000	208,084	Appropriation, 1917, \$375,000.		
Supplies.....	352,000	350,983	Appropriation, 1916, 375,000.		
Repairs.....	190,000	157,568			
Incidental expenses.....	25,000	26,871			
Light vessels:					
Rations and provisions.....	95,000	93,501			
Supplies.....	115,000	110,511			
Repairs.....	160,000	134,703			
Incidental expenses.....	2,000	2,137			
Depots:					
Pay of laborers and mechanics.....	80,000	83,513			
Rent.....	5,500	5,041			
Repairs and improvements.	120,000	119,721			
Incidental expenses.....	17,000	18,551			
Offices:					
Technical books and periodicals.....	400	287			
Stationery and office supplies.....	16,000	15,697			

SUMMARY OF ESTIMATES OF APPROPRIATIONS FOR THE LIGHTHOUSE SERVICE FOR THE FISCAL YEAR 1918.

FOR GENERAL MAINTENANCE OF THE LIGHTHOUSE SERVICE.

Salaries, Bureau of Lighthouses	\$64, 030
General expenses, Lighthouse Service	2, 850, 000
Salaries, Lighthouse Service	394, 600
Salaries, keepers of lighthouses	950, 000
Salaries, lighthouse vessels	1, 220, 000
Total	5, 478, 630

FOR SPECIAL WORKS.

Group 1. Works urgently necessary for the safety or immediate needs of navigation and for the preservation of existing structures or equipment, for the full utilization of other public improvements, or for the efficient equipment of the Lighthouse Service:

1. Lighthouse tender to replace tender <i>Gardenia</i> , or for general service	150, 000
2. Light vessel for Cape Charles, Va., or for general service	130, 000
3. Light vessels for general lakes service	150, 000
4. Guantanamo, Cuba, building keepers' dwelling and improving the lighting	14, 000
5. Pearl Harbor, Hawaii, aids to navigation	80, 000
6. Sandy Hook, N. J., aids to navigation	20, 000
7. Lighthouse depot for second district, construction	85, 000
8. Detroit, Mich., improvements to lighthouse depot	53, 000
9. Staten Island lighthouse depot, N. Y., improvement	21, 000
10. Huron Harbor, Ohio, aids to navigation	4, 500
11. Hawaiian Islands lighthouse depot, temporary structure	5, 000
12. Hawaiian Islands lighthouse depot, construction and equipment	90, 000
13. Point Borinquen Light Station, P. R., removal and rebuilding	85, 000
14. Light keepers' dwellings, construction	75, 000
15. Chicago Harbor Light Station, Ill., removing and rebuilding	88, 000
16. Fairport, Ohio, aids to navigation	42, 000
17. Sand Hills, Mich., establishment of light and fog-signal station	75, 000
18. Manitowoc Breakwater Light Station, Wis., improvement	21, 000
19. East River, N. Y., aids to navigation	16, 000
20. Keweenaw Waterway, Mich., aids to navigation	110, 000
21. Cape Charles City, Va., aids to navigation	12, 800
22. Chesapeake Bay and tributaries, Md. and Va., Eastern Shore, aids to navigation	29, 000
23. Alaska, aids to navigation	60, 000
24. Indiana Harbor, Ind., aids to navigation	100, 000
25. Great Salt Pond Light Station, R. I., improvement	25, 000
26. Radio installations on lighthouse tenders	60, 000
27. Washington and Oregon, aids to navigation	35, 000

Note: All of the foregoing items have been authorized by law.

28. Light vessel for Gulf Coast, La., or for general service	160, 000
29. Sand Island Light Station, Ala., improvements	45, 000
30. Spectacle Reef Light Station, Mich., improvements	28, 000
31. Lighthouse depot for fifth district, enlargement, improvement, or establishment of new depot	275, 000
32. Lighthouse tender, to replace tender <i>John Rodgers</i> , or for general service	180, 000
33. Lighthouse tender, to replace tender <i>Jessamine</i> , or for general service	180, 000
34. Communication systems to light stations	100, 000
Authorized by law	1, 636, 300
Not authorized	968, 000

Total group 1 **2, 604, 300**

Group 2. Works considered essential for the needs of navigation and the equipment of the Lighthouse Service, and which it is recommended be undertaken as resources permit, are submitted with estimates of cost. (These items have been selected from a much larger number of recommendations submitted by the inspectors of the lighthouse districts and others.)

35. Lighthouse tender to replace tender <i>Mistletoe</i> , or for general service	\$180,000
36. Lighthouse tender to replace tender <i>Holly</i> , or for general service..	180,000
37. Ludington, Mich., aids to navigation.....	35,000
38. Tampa Bay, Fla., aids to navigation.....	10,000
39. Delaware Bay entrance, improvement of aids to navigation.....	90,000
40. Goose Island Flats, N. J., establishment of light and fog-signal station.....	140,000
41. Alaska, lighthouse depot, purchase of site and construction and equipment.....	50,000
42. Point Pinos Light Station, Cal., improvement.....	29,000
43. Michigan Island, Wis., establishment of light and fog-signal station.	100,000
44. Kauhola Point Light Station, Hawaii, improvement.....	20,000
45. Goat Island Lighthouse depot, Cal., improvements.....	50,000
46. Santa Barbara Light Station, Cal., improvements.....	27,000
47. Cape Spencer, Alaska, establishment of light and fog-signal station.	100,000
48. Potomac River, Md., aids to navigation.....	120,000
49. Additional gas buoys, fifth lighthouse district.....	52,000
50. Portage Lake, Mich., establishment of light and fog-signal station and improvement of aids.....	100,000
51. Ram Island, Me., establishment of light.....	3,100
52. Cape Kumukahi, Hawaii, establishment of light.....	22,000
53. Henderson Point, Me., establishment of light and fog signal.....	3,800
54. Port Real, P. R., establishment of light station.....	40,000
55. Nine Mile Point, Mich., establishment of light and fog-signal station.	50,000
56. Anacapa Island, Cal., establishment of light and fog-signal station.	103,000
57. Caribbean Sea, aids to navigation.....	60,000
58. Galveston Jetty Light Station, Tex., improvements.....	6,700
59. Grays Harbor Light Station, Wash., improvements.....	10,000
Total, group 2 (not included in total of estimates).....	1,581,600

RECAPITULATION.

For general maintenance of the Lighthouse Service.....	5,478,630
For special works: Group 1.....	2,604,300
Total.....	8,082,930

DETAILED ESTIMATES FOR MAINTENANCE, 1918.

BUREAU OF LIGHTHOUSES.

Salaries.....	\$64,030
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GENERAL EXPENSES, LIGHTHOUSE SERVICE.

For supplies, repairs, maintenance, and incidental expenses of lighthouses and other lights, beacons, buoyage, fog signals, lighting of rivers heretofore authorized to be lighted, light vessels, other aids to navigation, and lighthouse tenders, including the establishment, repair, and improvement of beacons and day marks and purchase of land for same; the establishment of post lights, buoys, submarine signals, and fog signals; the establishment of oil or carbide houses not to exceed \$10,000: *Provided*, That any oil or carbide house erected hereunder shall not exceed \$550 in cost; the construction of necessary outbuildings at a cost not exceeding \$500 at any one light station in any fiscal year; the improvements of grounds and buildings connected with light stations and depots; wages of laborers attending post lights; pay of temporary employees and field force while engaged on works of general repair and maintenance and pay of laborers and mechanics at lighthouse depots; rations and provisions or commutation thereof for keepers of lighthouses, working parties in the field,

officers and crews of light vessels and tenders, and officials and other authorized persons of the Lighthouse Service on duty on board of such tenders or vessels; and money accruing from commutation for rations and provisions for the above-named persons on board of tenders and light vessels or in working parties in the field may be paid on proper vouchers to the person having charge of the mess of such vessels or parties; reimbursement under rules prescribed by the Secretary of Commerce of keepers of light stations and masters of light vessels and of lighthouse tenders for rations and provisions and clothing furnished shipwrecked persons who may be temporarily provided for by them, not exceeding in all \$5,000 in any fiscal year; fuel and rent of quarters where necessary for keepers of lighthouses; the purchase of land sites for fog signals; the rent of necessary ground for all such lights and beacons as are for temporary use or to mark changeable channels and which in consequence can not be made permanent; the rent of offices, depots, and wharves; traveling expenses, mileage, library books for light stations and vessels, and technical books and periodicals not exceeding \$1,000; and for all other contingent expenses of district offices and depots and for contingent expenses of the Office of the Bureau of Lighthouses in Washington, \$2,850,000.

Hereafter the appropriation, "General expenses, Lighthouse Service," shall be available, under regulations prescribed by the Secretary of Commerce, for the payment of traveling and subsistence expenses of teachers while actually employed by States or private persons to instruct the children of keepers of lighthouses.

Hereafter the limit of cost of necessary outbuildings at any one light station in any fiscal year shall not exceed \$500, and the appropriation, "General expenses, Lighthouse Service," is hereby made available for the payment thereof.

Hereafter all officers and employees engaged in the field service or on vessels of the Lighthouse Service who shall have reached the age of 65 years, after having been 30 years in the active service of the Government, may, at their option, be retired from further performance of duty; and all such officers and employees who shall have reached the age of 70 years shall be compulsorily retired from further performance of duty: *Provided*, That the annual compensation of persons so retired shall be a sum equal to one-fortieth of the last annual pay received for each year of active service in the Lighthouse Service, or in a department or branch of the Government having a retirement system, not to exceed in any case thirty-fortieths of the last annual pay received: *Provided further*, That such retirement pay shall not include any amount on account of subsistence or other allowance.

NOTE.—The amount estimated for is \$60,000 in excess of the appropriation for the fiscal year 1917, consisting of the following item: General increase of service, \$60,000.

This increase of \$60,000 is considered necessary on account of the increase in numbers of aids required for the safety of navigation, to keep the Lighthouse Service in an economical state of repair and efficiency, and because of the recent extraordinary advance in the price of labor and materials. The increase recommended is approximately 2.2 per cent over the appropriation for the fiscal year 1917, while the total number of aids was increased in 1916 from 14,535 to 14,947, an increase of 412, or 2.8 per cent. In order to keep pace with the constant development of commerce it is believed that proper provision for maintenance and repair as well as for the establishment of necessary additional minor aids frequently requested by mariners should be made. With the increasing numbers of requests for aids, it is impossible to render the full efficiency and service demanded unless adequate provision is made for funds. With respect to the general advance in prices of commodities, it may be stated that many items, such as steel plate and paints and paint materials, have advanced as high as three or four times normal figures, while practically all articles have advanced 5 per cent or over. It is therefore believed that the additional amount requested is conservatively small.

The foregoing estimate of appropriation for "General expenses, Lighthouse Service," includes a provision for allowing commutation of rations and provisions to working parties of the Lighthouse Service in the field. The members of working parties of the Lighthouse Service are furnished their subsistence when employed away from their homes and stations, but there is no authority for commuting the allowance, it being necessary either to provide subsistence in kind or reimburse the individuals for expenditures made by them for this purpose. It will facilitate the work of subsisting field parties and reduce the amount of clerical work in district offices if authority for commuting this subsistence is granted.

Authority is also requested for the payment of travel and subsistence expenses of teachers while engaged in instructing the children of lighthouse keepers. The question of providing proper educational facilities for children at isolated light stations is a matter that has received careful attention, and in some localities, notably in the

State of Maine, the State educational authorities have made provision for traveling teachers to instruct children at outlying stations, while ordinary school facilities are otherwise practically impossible. The State pays the teacher and provides the school books, and it is considered proper that the Lighthouse Service should cooperate in this meritorious work to the extent of providing for the travel and subsistence expenses of the teachers. Under the existing arrangements these expenses are paid in part by the State and by the keepers, and it is believed that a hardship is thus created on the keepers, who under their present very moderate salaries, can hardly afford such additional expenses. It may also be stated that in other Lighthouse Services, such as that of England, assistance is given toward the education of keepers' children by a so-called "educational grant," being an extra allowance of money for each child between the ages of 5 and 15 years at specified isolated stations, for expense in boarding out and educating such children.

Authority is also recommended, providing for an increase in the limit of cost of construction of necessary outbuildings at light stations in any fiscal year from \$200 to \$500. The limit of cost of \$200 authorized for this purpose has been contained in appropriation acts since the fiscal year 1902, since which time the cost of labor and materials has greatly increased. The effect of restriction to this small limit has been to cause the erection of numerous small unsubstantial buildings at light stations, making the premises unsightly, rather than a smaller number of larger and better structures at a greater cost per building. It is not anticipated that there will be any increase in the total expenditure for this purpose, and the more permanent type of structure possible with a higher limit of cost will prove economical as well as improve the appearance of light stations.

The item of legislation recommended above for the retirement of superannuated persons has been explained in the narrative portion of this annual report, on p. 25. It is estimated that approximately \$150,000 per annum would be required to provide for the compensation of persons retired under its provisions.

It is further recommended that consideration be given to the consolidation of the four general maintenance appropriations under the single appropriation "General expenses," by naming in the consolidated general appropriation a specific amount as the limit of all salary items included therein. It is believed that this step would effect a more economical and efficient administration of the Lighthouse Service by simplification of the accounting system, and permitting the costs of work to be kept in a more systematic and comprehensive manner, showing clearly for each principal feature the relative amounts paid for salaries, materials, supplies, equipment, and other component items. Among additional advantages of consolidation of items of general appropriation may be stated the following: (a) Laborers in charge of lights are now paid out of two different appropriations, those attending lights on rivers authorized by Congress to be lighted being paid out of general expenses, and those at other lights not on rivers being paid out of salaries of keepers; (b) commutation of rations of keepers and other employees (which may be properly considered as part of their compensation) now must be paid out of the appropriation "General expenses," while the salaries proper are paid out of the respective salary appropriations; (c) the items recommended for consolidation have natural limitations. For example, the number and average salary of keepers is limited by law. A necessary limitation is also imposed by the number of vessels in service. If such a consolidation of appropriations may be effected, it is believed that the total sum of the four general maintenance appropriations stated in these estimates, viz, \$5,414,600, may be reduced in the sum of \$25,000 to a revised total of \$5,389,600. This may be effected by reason of the fact that it is necessary to allow a small portion of each appropriation to be reserved for prevention of a deficiency prohibited by law, and if the appropriations be consolidated the amount reserved may be correspondingly reduced.

(See p. 68 for itemized estimate.)

SALARIES, KEEPERS OF LIGHTHOUSES.

For salaries of not exceeding 1,800 lighthouse and fog-signal keepers and laborers attending other lights, exclusive of post lights, \$950,000.

NOTE.—The amount estimated for is \$10,000 in excess of the appropriation for the fiscal year 1917, and is occasioned by the fact that a number of new light stations, built under special appropriations, will be ready to go into commission. The salaries of keepers are regulated by section 4673 of the Revised Statutes, which fixes an average of not exceeding \$600 per annum to each keeper. Under that authority and the present authorized complement of 1,800 keepers, the total authorized sum under this appropriation would be \$1,080,000, so that the amount estimated for is well within the limits fixed by existing law.

(See p. 68 for itemized estimate.)

SALARIES, LIGHTHOUSE VESSELS.

For salaries and wages of officers and crews of light vessels and lighthouse tenders, including temporary employment when necessary, \$1,220,000.

NOTE.—The amount estimated for is \$150,000 in excess of the appropriation for the fiscal year 1917, and is caused by the unprecedented situation in shipping conditions, making it quite impossible to obtain seamen, firemen, cooks, etc., at the former recognized standard rates of pay. In practically all grades, wages in the merchant service have advanced at least \$10 per month, and in order to man the vessels of the Lighthouse Service, it has been found necessary to pay the regular wage scale, particularly as the work of the Service is more difficult and dangerous, including such items as working buoys at sea, boating coal to light vessels and isolated light stations. Inasmuch as a total of 1,592 persons are now employed on lighthouse vessels the additional sum estimated for is considered as moderate as possible, consistent with the proper manning of vessels.

(See p. 68 for itemized estimate.)

SALARIES, LIGHTHOUSE SERVICE.

For salaries of 17 lighthouse inspectors, and of clerks and other authorized permanent employes in the district offices and depots of the Lighthouse Service, exclusive of those regularly employed in the office of the Bureau of Lighthouses, Washington, D. C., \$394,600. Hereafter the annual salaries of lighthouse inspectors, excepting the inspector of the third lighthouse district, shall not exceed \$3,000 each.

NOTE.—An increase of \$19,600 over the appropriation for the fiscal year 1917 is submitted, consisting of the following:

Additional clerks and draftsmen.....	\$10,000
Increase of salary for lighthouse inspectors.....	9,600
Total.....	19,600

The item of \$10,000 is occasioned by the general growth of the Service in order that the technical and clerical work of the district offices may be dispatched promptly. About 10 positions at salaries ranging from \$900 to \$1,500 per annum will be thus provided for.

The salaries of lighthouse inspectors are, by the act of June 17, 1910, limited to \$2,400 a year, except the inspector of the third district, whose salary is fixed at \$3,600. The salary of \$2,400 is inadequate because of the heavy responsibilities with which the inspectors are charged and the technical and business ability required to successfully discharge the duties. The compensation of these positions should be sufficient to bring into and retain in the Lighthouse Service a class of persons fully competent to efficiently conduct such important work. The inspectors should be men of high character and qualifications, including technical knowledge as to engineering and nautical affairs, and business ability. The salaries of lighthouse inspectors are materially less than those of various other officers of the Government whose requirements and responsibilities are not considered to be any greater. The Secretary of Commerce, at pages 145 and 146 of his annual report for the fiscal year 1915, described this situation fully, and attention is invited to his remarks on the subject. This provision for increasing the limit of salary of lighthouse inspectors was favorably considered by the committees of both Houses of Congress, and was included in the bill (H. R. 14338) as reported by the Committee on Interstate and Foreign Commerce April 15, 1916, and in the bill (S. 21) as reported by the Committee on Commerce May 29, 1916, and as passed by the Senate July 27, 1916.

(See p. 68 for itemized estimate.)

DETAILED ESTIMATES FOR SPECIAL WORKS, 1918.

GROUP No. 1.

Works urgently necessary for the safety or immediate needs of navigation and for the preservation of existing structures or equipment, for the full utilization of other public improvements, or for the efficient equipment of the Lighthouse Service.

No. 1. *Tender for third lighthouse district.*—For constructing or purchasing, and equipping a lighthouse tender to replace tenders worn out in service in the third lighthouse district, or in the Lighthouse Service generally, \$150,000.

NOTE.—The act of Aug. 28, 1916 (39 Stat., 537), authorized this vessel, but no appropriation was made therefor. There are three tenders in the third district that are old and of obsolete types, and should be replaced as soon as practicable by modern efficient vessels. These are the *Gardenia*, *John Rodgers*, and *Mistletoe*. All of these tenders to be kept in commission require repairs that are not warranted by their age and the service obtained from them. At least one new tender for this district is an urgent present need.

No. 2. Cape Charles, Va., light vessel.—For constructing and equipping a light vessel for station off Cape Charles, Va., or for general service, \$130,000.

NOTE.—The act of Aug. 28, 1916 (39 Stat., 537), authorized this vessel, but no appropriation was made therefor. Light vessel No. 49, heretofore assigned to Cape Charles station, which was built in 1890 and is of only 470 gross tonnage, and not self-propelling, breaks adrift from her moorings on frequent occasions, and on December 5, 1914, narrowly escaped destruction. The loss of moorings alone in past years has amounted to over \$3,500. Owing to the exposed station and the importance of this aid to navigation, a first-class self-propelling light vessel is required. Relief vessel No. 101 is now occupying the station. Moreover, of the 66 light vessels in the service a number are more than 50 years old. To relieve these vessels for necessary repairs and overhauling and to place the older ships on less exposed stations, it is necessary that new vessels be added to the fleet.

No. 3. Light vessels for general Lake service.—For constructing and equipping light vessels for general service on the Great Lakes, or for general service, \$150,000.

NOTE.—The act of August 28, 1916 (39 Stat., 537), authorized these vessels, but no appropriation was made therefor. Light vessels No. 55, No. 56, No. 57, No. 60, No. 61, and No. 62, now stationed on the Great Lakes, are all old, built of wood, and are rapidly deteriorating. Light vessel No. 59 was, during the summer of 1914, condemned as unseaworthy, and was removed from her station at Poe Reef, southern entrance to Straits of Mackinac, Mich. Of the others, light vessels No. 61 and No. 62 are in especially bad condition, and can not be depended upon for service in the stormy fall season. It is proposed to construct two or more vessels, similar in type to those recently built for Lake service, of steel, and fitted with modern light and fog-signal apparatus.

No. 4. Guantanamo, Cuba, aids to navigation.—For dwelling for keepers of the lights in Guantanamo Bay, Cuba, and improving the lighting, \$14,000.

NOTE.—The act of July 27, 1912 (39 Stat., 239), authorized the construction of these works, but no appropriation was made therefor. The dwelling at this station was destroyed during the insurrection following the war of 1898, and since the occupation of Guantanamo by the United States the keepers have been compelled to live in a wooden shack with only three rooms and an old stable to house three keepers. The lights in charge of these three keepers are widely separated. With the installation of acetylene lights as proposed, the service of one keeper may be dispensed with. Detailed estimate:

Dwelling for two keepers.....	\$3,000
2 acetylene lights at Fisherman Point.....	2,800
2 acetylene lights at Hicacal Beach.....	2,800
Contingencies.....	400
Total.....	\$14,000

No. 5. Pearl Harbor, Hawaii, aids to navigation.—For establishing aids to navigation in Pearl Harbor, Hawaii, \$80,000.

NOTE.—The act of March 3, 1915 (38 Stat., 927), authorized this work, but no appropriation was made therefor. In view of the fact that the Government has authorized the establishment of a naval station at this point, it is important that the channels and entrance be properly marked; this is rendered more important by the set of the current, which is usually across the channel in the approach, and also on account of the prevailing northeasterly winds. The necessary aids to navigation should be available at the completion of the harbor improvements. It is proposed to establish 9 lighted and 9 unlighted beacons, also 2 gas buoys at the entrance. The Secretary of the Navy, by letter of August 12, 1913, requested favorable consideration for the establishment of suitable aids to navigation in Pearl Harbor and in a subsequent letter, dated March 29, 1916, informed the Secretary of Commerce that all naval activities in the Hawaiian Islands are now centered at Pearl Harbor, and urgently recommended that steps be taken for the establishment of the aids in question as soon as possible. Detailed estimate:

2 gas lighted buoys.....	\$10,000
4 lighted beacons in exposed waters, at \$5,600.....	22,400
5 lighted beacons in unexposed waters, at \$3,500.....	17,500
2 unlighted beacons in exposed waters, at \$4,000.....	8,000
7 unlighted beacons in unexposed waters, at \$2,100.....	14,700
Contingencies.....	7,400
Total.....	80,000

No. 6. Sandy Hook, N. J., aids to navigation.—For improving the aids to navigation at Sandy Hook, N. J., \$20,000.

NOTE.—The act of March 3, 1915 (38 Stat., 926), authorized this work, but no appropriation was made therefor. North Hook Beacon Light and Fog Signal, N. J., are at present so located in front of the batteries at Fort Hancock, Sandy Hook, N. J., as to interfere very seriously with the gun fire of several of the batteries, and absolutely prohibits the training of the guns on the ranges covering the entrances to New York Harbor. The matter has been carefully investigated by representatives of the War Department and of the Lighthouse Service, and the views of maritime interests obtained relative to the best methods of making the necessary changes. It is recommended that the keepers' quarters, light, and fog signal be moved to a new location out of range of the batteries. This project has been strongly urged by the War Department, in letter of April 1, 1916, which stated that the present interference with the batteries is serious, and warrants remedial action at the earliest practicable date. Detailed estimate:

Moving and raising light, with new foundation.....	\$7,000
Building new fog-signal house and moving engines.....	5,000
Moving, relocating, and repairing three keepers' dwellings.....	6,000
Contingencies.....	2,000
Total.....	20,000

No. 7. Depot for second lighthouse district.—For constructing and equipping a lighthouse depot for the second lighthouse district, \$85,000.

NOTE.—The act of August 28, 1916 (39 Stat., 537), authorized this work, but no appropriation was made therefor. The present depot of the second district for Boston Harbor and vicinity is on Lovells Island, and is there through the courtesy of the War Department only. It is not adapted or situated for a depot where the work can be carried on expeditiously. Lighthouse tenders can not lie there nights on account of being exposed to the weather, and passing steamers make such a swash that the tender's lines are parted. The tide has been known to cover the floor of the storehouse to a depth of 1 foot. The buildings, with the exception of the oil house, are wooden, and in poor condition of repair. The wharf is also in poor condition of repair. The Treasury Department has arranged to transfer a piece of the old marine hospital property in Chelsea to the Lighthouse Service at the expiration of the present lease, which takes place December 31, 1916. This property by dredging will have three berths for vessels, ample storage room for buoys, and with a brick fire-proof storehouse would make a first-class depot. Detailed estimate:

Wharf.....	\$11,000
Sea wall.....	11,000
Oil house.....	1,500
Service building.....	35,000
Depot keeper's dwelling.....	6,000
Storehouse.....	3,500
Machine and blacksmith shop.....	2,000
Buoy skid and chain platform.....	1,000
Dredging.....	8,000
Removing present structure from grounds.....	500
Excavating and laying water pipes.....	500
Boundary fence.....	1,500
Contingencies.....	3,500
Total.....	85,000

No. 8. Detroit, Mich., lighthouse depot.—For improvements at Detroit, Mich., lighthouse depot, \$53,000.

NOTE.—The act of August 28, 1916 (39 Stat., 537), authorized this work, but no appropriation was made therefor. The following improvements are needed:

Oil house: The arrangements for storage of oil at this depot are very inadequate and unsatisfactory, and oil is stored in one wing of the basement of the main storehouse. The capacity is, however, insufficient, making it necessary to store large quantities of oil in the depot yard, exposed to possible damage or total destruction by fire, owing to the proximity of a varnish works. Furthermore, the handling of oil would be greatly facilitated, as the new structure could be so located as to handle the oil directly from the cars.

Addition to lamp shop: The present lamp shop is greatly overcrowded, owing to the increasing number of lighted buoys and other aids in the district, necessitating a greater and increasing quantity of parts returned for repair. Spare parts can not be accommodated but must be stored in the main storehouse, inconveniently located for the work. It is necessary to do a great deal of blacksmith repair work to moorings of buoys, etc., at the depot during the closed season of navigation, and this work must now be done in the open part of the buoy shed under very severe weather conditions during the winter or at times delayed until the severe storms are over.

Storehouse for cement and lime: Owing to the large amount of construction and repair work necessary in this district, a considerable quantity of cement and lime must be kept on hand. A small building for this storage should be provided.

Reconstruction of wharf: The wharf here has undergone for many years only such repair as necessary to render it serviceable. It is an old wooden structure on cast-iron columns standing on piles cut off about a foot below water level. It should be rebuilt and extended out to the pier line to give additional capacity.

Detailed estimate:

Oil house.....	\$4,000
Addition to lamp shop.....	5,000
Cement and lime storage.....	2,000
Reconstruction of wharf.....	38,000
Contingencies.....	4,000
Total.....	53,000

No. 9. Staten Island, N. Y., lighthouse depot.—For improvement of the offices and laboratory at the general lighthouse depot, Tompkinsville, Staten Island, N. Y., \$21,000.

NOTE.—The act of August 28, 1916 (39 Stat., 537), authorized this work, but no appropriation was made therefor. The present office quarters and laboratory at the general depot, Tompkinsville, N. Y., are located in four detached buildings, giving rise to delay and confusion in the orderly handling of work, as well as causing unnecessary expense of heating and other maintenance items. It is proposed to construct an addition which will join three of the present buildings, and make it possible to use the space so gained for the improvement of the laboratory, which is now located in the fourth building. This building is poorly adapted for laboratory purposes, but can be put to good use as a storehouse, which is also needed on account of the growth of the Service. Detailed estimate:

Altering old buildings.....	\$4,500
Foundation.....	1,500
Walls, rough floors, and roof.....	8,000
Interior finish, etc.....	5,000
Contingencies.....	2,000
Total.....	21,000

No. 14. *Light keepers' dwellings*.—For light keepers' dwellings and appurtenant structures, including sites therefor, within the limit of cost fixed by act approved February 26, 1907, \$75,000.

NOTE.—The act of August 28, 1916 (39 Stat., 537), authorized this work, but no appropriation was made therefor. The appropriations made March 4, 1907 (34 Stat., 1319), and May 27, 1908 (35 Stat., 334), of \$75,000 each, are now exhausted, but dwellings at a number of stations are yet needed, among which may be stated: Amelia Island, Fla.; Ano Nuevo Island, Cal.; Buffalo Breakwater, N. Y.; Charlotte, N. Y.; Diamond Head, Hawaii; Dry Tortugas, Fla.; Frankfort, Mich.; Ludington Breakwater, Mich.; Oswego Breakwater, N. Y.; Piedras Blancas, Cal.; Point Hueneme, Cal.; Point Montara, Cal.; Point Sur, Cal.; Port Eads, La.; Port San Juan, P. R.; Poverty Island, Mich.; Robinson Point, Wash.; Sand Island, Ala.; Tawas, Mich.; Toledo Harbor, Ohio; Two Harbors, Minn. Detailed estimate:

16 dwellings, at \$4,500.....	\$72,000
Contingencies.....	3,000
Total.....	75,000

No. 15. *Chicago Harbor Light Station, Ill.*—For removing and rebuilding Chicago Harbor Light Station, Ill., and establishing lights on the new breakwater in Chicago Harbor, \$88,000.

NOTE.—The act of August 28, 1916 (39 Stat., 537), authorized this work in the sum of \$142,000, but no appropriation was made therefor. It is believed that the revised estimate of \$88,000 will accomplish the purpose properly. The present Chicago Harbor Light Station is built on an isolated pier at the southeast end of the existing outer breakwater. The United States engineers are planning the construction of two new breakwaters with a gap between, running south from the existing breakwater, and expect to have the first section of this project completed by December, 1916. This will necessitate the moving of the present Chicago Harbor Light from its present position to the proposed entrance of the outer harbor of Chicago, Ill. The War Department proposes to build a stone and timber crib at the south end of the north arm of the new breakwater as a foundation for the main light, and will also provide foundations for minor lights at the north and south ends of the south breakwater. It is then proposed that the Lighthouse Service will construct a concrete pier on top of the crib and then rebuild the present cast-iron tower and lantern, building a new steel brick-lined fog-signal building, reinstalling present illuminating and fog-signal apparatus, and providing also a new steel boat and store house with suitable steam-power derricks. Reinforced concrete foundations with structural steel skeleton towers are contemplated for the flashing acetylene minor lights. This project is urgent, as the light should be moved to its new location as soon as practicable after completion of the new breakwaters, and has been strongly urged by the War Department. Detailed estimate:

Stone and timber crib for main light.....	\$20,000
Reinforced concrete pedestal.....	30,000
Taking down and rebuilding tower, lantern, and lens.....	5,000
New fog-signal building.....	10,000
New boat and store house.....	5,000
New derrick.....	1,200
Foundations for minor lights.....	4,000
Towers for minor lights.....	2,000
Illuminating apparatus for minor lights.....	3,000
Contingencies.....	7,800
Total.....	88,000

No. 16. *Fairport, Ohio, aids to navigation*.—For improving the aids to navigation at Fairport Harbor, Ohio, \$42,000.

NOTE.—The act of August 28, 1916 (39 Stat., 537), authorized this work, but no appropriation was made therefor. The completion of the west breakwater pierhead necessitates a rearrangement of the aids to navigation at this harbor. It is proposed to discontinue the present main light on the bluff and to construct the new light with a fog signal on the pierhead. The west breakwater and pierhead have been completed, and on the east side the breakwater has been built up to the water line throughout its length and the pierhead crib has been placed. The annual number of vessels entering and departing is about 1,300, representing a total registered tonnage of approximately 3,000,000. Detailed estimate:

Structure.....	\$24,000
Illuminating apparatus.....	6,500
Fog-signal apparatus.....	8,000
Boats, piping, etc.....	3,500
Total.....	42,000

No. 17. *Sand Hills, Mich., Light Station*.—For establishing a light station and fog signal at or near Sand Hills, Mich., \$75,000.

NOTE.—The act of August 28, 1916 (39 Stat., 537), authorized this work, but no appropriation was made therefor. A light and fog-signal station at Sand Hills, about 4 miles west of Eagle River, Keweenaw Peninsula, Lake Superior, would be of great service to vessels bound east from the western portion of Lake Superior in warning vessels from the dangerous reefs off the coast. It is reported that 10 vessels stranded on these reefs in recent years, with known losses of over \$1,000,000. Detailed estimate:

Tower.....	\$30,000
Fog signal.....	12,000
Quarters for three keepers.....	15,000
Outbuildings, dock, boat, etc.....	10,000
Contingencies.....	8,000
Total.....	75,000

No. 18. *Manitowoc Breakwater, Wis., Light Station.*—For improving the light and fog-signal station at Manitowoc North Breakwater, Wis., \$21,000.

NOTE.—The act of August 28, 1916 (39 Stat., 537), authorized this work, but no appropriation was made therefor. The present frame building, with corrugated-iron covering, with very small wooden lantern (not large enough to admit a man), stands on the outer end of the North Breakwater, which is of stone-filled timber construction. The building is old and in poor condition. The timber sills supporting the building are badly rotted. The other timberwork is deteriorating. Covering plates are rusting and breaking away at bottom. Cement floor is cracked and the building itself is shaky, due to movement and settlement of pier and to the fact that the building has been moved twice. It is liable to destruction in its exposed position and should be replaced at an early date with a steel building on a concrete base. It is proposed to install an electric-driven air compressor, obtaining current from the city, with oil-engine reserve drive, and to provide a brighter light. Detailed estimate:

New fog-signal building, with lantern.....	\$8,500
Fog-signal apparatus.....	6,500
Illuminating apparatus.....	4,100
Contingencies.....	1,900
Total.....	21,000

No. 19. *East River, N. Y., aids to navigation.*—For improving the aids to navigation on the East River, N. Y., \$16,000.

NOTE.—The act of August 28, 1916 (39 Stat., 537), authorized this work, but no appropriation was made therefor. Improvements and changes in system of lights in East River, N. Y., in vicinity of Hell Gate are very much needed, for the present system is inefficient as well as difficult to maintain, especially during the winter with running ice in the river. An appropriation for improving and changing these aids, building new foundations, and establishing acetylene lights in place of present oil lights at Mill Rock Northerly Light, Lawrence Point Ledge Light, Sunken Meadow Light, South Brother Island Ledge Light, Rikers Island Light is recommended. Oak Bluff Light, which is at present of very little service on account of many shore lights now in the vicinity, can be discontinued. Detailed estimate:

Foundations.....	\$9,000
Steel towers and tank houses.....	1,000
Gas tanks and lighting apparatus.....	6,000
Total.....	16,000

No. 20. *Keweenaw Waterway, Mich., aids to navigation.*—For establishing and improving aids to navigation at or near the entrance to Keweenaw Waterway Harbor of Refuge, Portage River, Mich., \$110,000.

NOTE.—The act of August 28, 1916 (39 Stat., 537), authorized this work, but no appropriation was made therefor. The improvements by the War Department are now in progress and will probably be carried through to completion at an early date. Steps should be taken as soon as possible by the Lighthouse Service looking to the proper lighting of the entrance under the new conditions. It is recommended that a light and fog signal be erected on a separate foundation on the outer end of the breakwater, and that six nonattended lights be established to mark the harbor, and, as the work will necessitate changes at the locality, that present range lights Nos. 1 and 2 be rebuilt and provided with gas appliances. The Portage River (Main) Light may be discontinued on the completion of this project, and the dwelling retained as shore station for one keeper. Detailed estimate:

Foundation and concrete base for tower.....	\$43,000
Superstructure.....	24,000
Illuminating and fog-signal apparatus.....	9,000
Establishing six minor lights.....	24,000
Rebuilding lights Nos. 1 and 2.....	6,000
Contingencies.....	4,000
Total.....	110,000

No. 21. *Cape Charles City, Va., aids to navigation.*—For improving lights and fog signals leading to Cape Charles City, Va., \$12,800.

NOTE.—The act of August 28, 1916 (39 Stat., 537), authorized this work, but no appropriation was made therefor. Harbor improvements at this point in recent years have rendered Cherrystone Light and Fog Signal of little use in the present location. A new light and fog bell should be established close to turn in dredged channel and range lights should be established for dredged channel. It is proposed to establish acetylene-gas lights and electrically operated fog-bell strikers. The illuminating apparatus on existing aids in this harbor should be improved by the installation of acetylene gas instead of present oil lights. Detailed estimate:

New concrete structure for light and fog bell.....	\$2,500
Illuminating apparatus.....	1,500
Fog-bell striker and electric cable.....	2,820
Structural steel tower and foundation.....	1,000
Apparatus for three acetylene range lights.....	3,180
Apparatus for two minor lights in vicinity.....	800
Contingencies.....	1,000
Total.....	12,800

No. 22. *Chesapeake Bay, Md. and Va., aids to navigation.*—For establishing and improving aids to navigation on the eastern shore of Chesapeake Bay and tributaries, Maryland and Virginia, \$29,000.

NOTE.—The act of August 28, 1916 (39 Stat., 537), authorized this work, but no appropriation was made therefor. The eastern shore of Chesapeake Bay presents an intricate system of waterways which are inadequately lighted. The deep channels are narrow and crooked, and the wide flats are covered by only a few

feet of water. The interests of a large part of the population of this country are maritime, large numbers of passengers are carried on regular lines of steamers to many ports, great quantities of truck and other produce move by water to Baltimore, and the fish, crab, and oyster industries are very important. The following items are considered necessary to provide an adequate system of lighted aids for these waters. Detailed estimate:

20 structures for minor lights.....	\$6,000
15 acetylene equipments.....	6,000
5 oil equipments.....	300
5 structures, unlighted beacons.....	1,500
12 gas buoys and moorings.....	14,400
Contingencies.....	800
Total.....	29,000

No. 23. *Alaska, aids to navigation.*—For the establishment of aids to navigation and the improvement of existing aids in Alaska, \$60,000.

NOTE.—The act of August 28, 1916 (39 Stat., 538), authorized this work, but no appropriation was made therefor. The appropriation of \$60,000 made by the act of August 1, 1914, has been practically exhausted by the completion of construction of aids already authorized. Maritime interests are urging the establishment of additional aids to assist the mariner in Alaskan waters, where navigation is unusually difficult and dangerous and where wrecks and costly accidents to vessels are of frequent occurrence. The commerce of the district is increasing in volume, owing in part to the opening of the Panama Canal and the inauguration of construction work on the Government railroad, and new routes of navigation are being opened up. Additional fog signals are needed on the principal channels of southeastern Alaska, and additional unwatched lights should be installed as soon as possible on the main route from Ketchikan to Skagway, in Icy Straits, in Peril Strait, and Sitka Sound, on the west coast of Prince of Wales Island, in Prince William Sound, and on the coast between Resurrection Bay and Cook Inlet. Detailed estimate:

17 lights.....	\$26,400
3 gas buoys.....	9,600
2 fog-signal installations.....	24,000
Total.....	60,000

No. 24. *Indiana Harbor, Ind., aids to navigation.*—For establishing and improving aids to navigation at Indiana Harbor, Ind., \$100,000.

NOTE.—The act of August 28, 1916 (39 Stat., 537), authorized this work, but no appropriation was made therefor. The War Department, through the Corps of Engineers, United States Army, is now constructing breakwaters at Indiana Harbor, Ind., and the Chief of Engineers, in a letter dated February 5, 1916, transmitted the views of his office in reference to aids to navigation which should be provided at this place, which is of commercial importance on account of the plants of large steel companies. It is recommended that a lighthouse and fog signal, with a crib foundation built into and forming a part of the breakwater on which it is placed, be established on the axis of the breakwater at the east end of the north arm (West Breakwater); and a smaller light, on a concrete pedestal, be erected at the north end of the south arm (East Breakwater). It is proposed to provide incandescent oil vapor for the main light, with a compressed-air fog signal, and acetylene illumination for the minor light. Detailed estimate:

Foundation crib.....	\$20,000
Concrete superstructure.....	30,500
Steel tower, fog signal, and quarters for three keepers, combined in one structure.....	22,000
Fog-signal apparatus in duplicate.....	8,500
Illuminating apparatus.....	5,200
Power derrick, boats, and outfit.....	2,800
Foundation for minor light.....	1,600
Illuminating apparatus for minor light.....	1,200
Contingencies.....	8,200
Total.....	100,000

No. 25. *Great Salt Pond Light Station, R. I.*—For improvements at Great Salt Pond Light Station, R. I., \$25,000.

NOTE.—The act of August 28, 1916 (39 Stat., 537), authorized this work, but no appropriation was made therefor. The present fog signal is located on the inner end of the breakwater, and is not properly located to be an efficient aid. The building in which the signal is located, and in which the keeper also lives, is unsightly and in poor condition. It is proposed to move the fog signal to the outer end of the breakwater, and to rebuild the station and quarters. Detailed estimate:

Improving and rebuilding the station.....	\$12,000
New fog-signal machinery.....	6,000
New signal house on breakwater.....	5,000
Contingencies.....	2,000
Total.....	25,000

No. 26. *Radio installations on lighthouse tenders.*—For furnishing all seagoing tenders in the Lighthouse Service with radio equipment and auxiliary power for the operation thereof, \$60,000.

NOTE.—The act of August 28, 1916 (39 Stat., 538), authorized this work, but no appropriation was made therefor. This item is believed to be an important matter for the greater efficiency of the Lighthouse Service, in order to permit of prompt communication of orders and information, thereby avoiding unnecessary steaming to points where mail or telegraph facilities are at hand. It is also believed that these installations on Government vessels would be of general public benefit in the saving of life and property, or similar emergencies. About 24 vessels in the fleet of lighthouse tenders may be considered seagoing, and it is recommended that each of these be equipped with a radio set of moderate power, having a sending radius of from 200 to 600 miles, at an estimated cost of about \$2,500 per vessel, which would include in some instances necessary alterations or additions to the vessel.

No. 27. *Washington and Oregon, aids to navigation.*—For the establishment of aids to navigation and improvement of existing aids in Washington and Oregon, seventeenth lighthouse district, \$35,000.

NOTE.—The act of August 28, 1916 (39 Stat., 538), authorized this work, but no appropriation was made therefor. There has been an increasing demand from shipping interests for additional lighted aids in these waters. It is also desirable to improve a number of existing aids which are now obsolete and unsatisfactory. Gas buoys are desired at Coos Bay, Oreg., Grays Harbor, Willapa Bay, Georgia Strait, and Puget Sound Wash., and improved lights at a number of places in the lower Columbia River, Wash. and Oreg., and on Clark and Cypress Islands, Wash. Detailed estimate:

7 gas-lighted buoys, at \$3,000.....	\$21,000
14 unwatched gaslights, at \$1,000.....	14,000
Total.....	35,000

No. 28. *Gulf coast, La., light vessel.*—For constructing and equipping a light vessel for the Gulf of Mexico coast, La., or for general service, \$160,000.

NOTE.—The act of October 22, 1913 (38 Stat., 224), appropriated funds for a light vessel for Southwest Pass, but did not provide for South Pass, where there is urgent need for a similar vessel, as both passes are open and used. In the year 1913 over 3,600 vessels, with a tonnage of over 8,000,000, entered the port of New Orleans, and the total value of imports and exports during that period was over \$314,000,000. It is proposed to construct a steel self-propelling vessel equipped with modern light and fog-signal apparatus, similar to that authorized for Southwest Pass.

No. 29. *Sand Island Light Station, Ala.*—For improving Sand Island Light Station, Ala., \$45,000.

NOTE.—In October, 1906, a storm destroyed the dwelling at this station, and since that time the keepers have used the tower as a dwelling. These quarters are not suitable and it is recommended that a dwelling be erected. There is great need for a fog signal at this station, which at present has none. Fog prevails for a large portion of the winter and spring seasons, making the entrance to Mobile Bay difficult and dangerous at times. It is recommended that the station be equipped with modern fog-signal apparatus. The brick tower, which was originally erected on Sand Island, now stands surrounded by an artificial island of rock, the sand island having washed away. The station was again severely damaged by the hurricanes of 1915 and 1916 and the need of these improvements is urgent. The quantity of rock protection around the tower should be increased, about 3,000 tons of rock being required. Detailed estimate:

Riprap.....	\$26,000
Dwelling for three keepers.....	8,000
Fog-signal building.....	3,000
Fog-signal apparatus.....	7,000
Contingencies.....	1,000
Total.....	45,000

No. 30. *Spectacle Reef Light Station, Mich.*—For improving Spectacle Reef Light Station, Mich., \$28,000.

NOTE.—The wall surrounding the tower and supporting the fog-signal building and boathouse is disintegrating at the water line and should be repaired before further damage occurs. It is proposed to place a belt of steel flashing around the entire pier, commencing about 4 feet below the water line and extending about 3 feet above, fastening the same by heavy expansion bolts and back filling the voids with concrete after placing the plate. The station has been carefully inspected from time to time, and recent examinations indicate that the abrasion is increasing each winter, and an appropriation is urgently recommended. Detailed estimate:

Steelwork in place.....	\$10,500
Concrete backing.....	10,000
Anchor bolts.....	3,500
Contingencies.....	4,000
Total.....	28,000

No. 31. *Depot for fifth lighthouse district.*—For enlarging and improving the lighthouse depot at Portsmouth, Va., in the fifth lighthouse district, or for establishing a new depot, \$275,000.

NOTE.—The present lighthouse depot at Portsmouth, Va., is entirely inadequate to the needs of the fifth district, both in area and in water front. This is the principal depot of one of the largest lighthouse districts and is the headquarters for five tenders and two light vessels during the greater part of the year. The aggregate length of these vessels is over 1,000 feet; the total wharf frontage is only 445 feet, of which over 200 feet is in a narrow slip available for small light-draft vessels only. The operation of tenders is much hampered by this limited frontage. The very small area available for buoy storage necessitates much otherwise unnecessary handling of heavy buoys and appendages at large cost of time and money. The available wharf frontage of this depot should be doubled, and the area increased by from 4 to 6 acres. This may be done by purchase of a new and larger site, or by purchase of adjacent property. The present buildings are mainly antiquated wooden structures. They constitute a fire menace and should be replaced by modern fireproof buildings. Detailed estimate:

Purchase of water-front property.....	\$125,000
Construction of wharf.....	52,125
Filling, grading, and paving.....	42,000
Storehouse, coal shed, repair shop, and keepers' dwelling.....	37,375
Water mains, fire-protection system, and traveling electric crane.....	8,500
Contingencies.....	10,000
Total.....	275,000

No. 32. *Tender for third lighthouse district.*—For constructing, or purchasing, and equipping a lighthouse tender to replace the tender *John Rodgers*, worn out in service in the third lighthouse district, or in the Lighthouse Service generally, \$180,000.

NOTE.—There are three tenders in the third district that are old and of obsolete types, and should be replaced as soon as practicable by modern efficient vessels. These are the *Gardenia*, *John Rodgers*, and *Mistletoe*. All of these tenders to be kept in commission require repairs that are not warranted by their age and the service obtained from them. At least one new tender for this district is an urgent present need, and should be followed by other tenders as rapidly as funds become available.

No. 33. *Tender for fifth lighthouse district.*—For constructing, or purchasing, and equipping a lighthouse tender to replace the tender *Jessamine*, worn out in service in the fifth lighthouse district, or in the Lighthouse Service generally, \$180,000.

NOTE.—The remarks in the item next above apply also to the tenders *Jessamine* and *Holly*, in the fifth district. These are old side-wheel steamers which should be replaced by modern efficient vessels as soon as practicable. The tender *Jessamine* is at present in need of repairs, at an expense not warranted by the age and general condition of the tender, and should be laid up and condemned before a general breakdown occurs.

No. 34. *Communication systems to light stations.*—For furnishing principal isolated light stations with telegraph, telephone, or radio communication systems, so far as funds permit, to be expended in cooperation with the Treasury Department, in connection with the coast communication system of the Coast Guard, \$100,000.

NOTE.—A study has recently been made of the general arrangements for Government coast communications along the seaboard of the United States by the Department of Commerce, in cooperation with the Treasury, War, Navy, and Agriculture Departments, from which it appears that light stations in many instances might be used to greater public advantage in occasions of emergency or other times of need. A number of recent cases, such as the wreck of the S. S. *Bear* near Cape Mendocino Light Station, Cal., on June 15, 1916, and of the steam schooner *Shua-Yak* near Point Sur Light Station, Cal., on July 21, 1916, illustrate clearly the good use to which such installations could be put. The expense of providing all light stations with such equipment is not recommended at present, but it is considered that a moderate policy of installing communication systems at important points should be inaugurated as soon as funds permit. It is understood that the United States Coast Guard, Treasury Department, has under consideration a comprehensive study of coast communications with light stations and other important points; and the Lighthouse Service desires to cooperate fully in this important work.

Total group No. 1, authorized by law, \$1,636,300; not yet authorized, \$968,000; total, \$2,604,300.

GROUP No. 2.

Works considered essential for the needs of navigation and the equipment of the Lighthouse Service, and which it is recommended be undertaken as resources permit, are submitted with estimates of cost. (These items have been selected from a much larger number of recommendations submitted by the inspectors of the lighthouse districts and others.)

No. 35. *Tender for third lighthouse district.*—For constructing, or purchasing, and equipping a lighthouse tender to replace the tender *Mistletoe*, worn out in service in the third lighthouse district, or in the Lighthouse Service generally, \$180,000.

NOTE.—The *Mistletoe* has been referred to in preceding items, and is an old, unseaworthy, side-wheel steamer, built in 1872, which should be replaced as soon as funds permit.

No. 36. *Tender for fifth lighthouse district.*—For constructing, or purchasing, and equipping a lighthouse tender to replace the tender *Holly*, worn out in service in the fifth lighthouse district, or in the Lighthouse Service generally, \$180,000.

NOTE.—The *Holly* is a side-wheel steamer, built in 1881, and has outlived its usefulness and should be replaced as soon as funds permit.

No. 37. *Ludington, Mich., aids to navigation.*—For improving the aids to navigation and establishing new aids at Ludington, Mich., \$35,000.

NOTE.—The present location of the fog-signal station on the end of south pier subjects vessels to danger of striking the breakwater. The commerce of Ludington, which includes important car-ferry lines across Lake Michigan, is as important as any other port on the east shore of Lake Michigan, and as this port is most inadequately lighted now this improvement is considered well warranted. It is proposed to establish a main light on the outer end of the north breakwater, with fog-signal apparatus, consisting of electrically driven air compressor and siren with oil engine reserve drive, and to discontinue the present steam fog signal in old wooden structure. Quarters for keepers should be erected adjacent to the light, as it is unsafe to cross the harbor during the winter when the ice is broken up by car ferries. Detailed estimate:

Foundation and tower.....	\$4,500
Fog-signal building.....	2,600
Illuminating apparatus.....	2,350
Fog-signal apparatus.....	6,500
Quarters for three keepers, including site.....	15,950
Minor lights on north and south pierheads.....	2,600
Contingencies.....	410
Total.....	\$35,000

No. 43. *Michigan Island, Wis., Light Station.*—For establishing a light and fog-signal station on Michigan Island, Lake Superior, Wis., \$100,000.

NOTE.—The act approved May 27, 1908 (35 Stat., 332), appropriated \$2,000 to make a survey and estimate the cost and report upon the feasibility and need of establishing a light and fog signal upon Gull Island or the easterly end of Michigan Island, Apostle Group. As a result of this survey, the conclusion has been reached that the eastern end of Michigan Island is the better site. The act of June 17, 1910 (36 Stat., 536), authorized the construction of a light and fog-signal station at Michigan and Gull Islands at a cost not to exceed \$140,000, but no appropriation has been made therefor. Detailed estimate:

Tower and fog-signal building.....	\$45,000
Illuminating apparatus.....	7,000
Fog signal.....	9,000
Dwellings for three keepers.....	18,000
Outbuildings, boats, etc.....	6,000
Fences, walks, derricks, etc.....	5,000
Contingencies.....	10,000
Total.....	100,000

No. 44. *Kauhola Point, Hawaii, Light Station.*—For improving the light station at Kauhola Point, Hawaii, \$20,000.

NOTE.—Owing to the importance of this station, located near the northern point of the Island of Hawaii, steps have been taken to change the present lens-lantern light to a converted flashing fourth-order lens. To support this lantern and lens and to complete the improvement of this station, a new tower is necessary. A dwelling for the assistant keeper should also be provided. Detailed estimate:

75-foot cast-iron tower.....	\$10,000
Erection at site complete.....	4,000
Dwelling.....	4,000
Contingencies.....	2,000
Total.....	20,000

No. 45. *Goat Island, Cal., lighthouse depot.*—For repairs and improvements to Goat Island lighthouse depot, near San Francisco, Cal., \$50,000.

NOTE.—This depot occupies a small area gained by cutting down the steep bluff at the southeast point of Goat Island in San Francisco Bay and filling in along the shore line with the material thus secured. This area and that afforded by the present wharf are now inadequate to afford a proper disposition of the property required to be stored there. This is the only depot in the district. An additional area should be filled in with excavated material to afford room for new storehouses and additional room for storing buoys. The present storehouses are merely wooden sheds, old and poorly constructed. The present wharf should be extended to afford room for working two tenders alongside at the same time, and to permit landing and loading supplies without having to shift material already stored on the wharf. The quarters provided for the depot force are old and insanitary in arrangement and location. New quarters for the keeper and assistant keeper of the depot should be provided on higher ground and the site of the present quarters utilized for the needs of the depot proper. Detailed estimate:

Retaining wall and fill.....	\$5,000
Storehouse, reinforced concrete.....	18,000
Wharf, additional, on iron piles.....	12,000
Dwellings.....	15,000
Total.....	50,000

No. 46. *Santa Barbara, Cal., Light Station.*—For improving Santa Barbara Light Station, Cal., \$27,000.

NOTE.—The station is old and the tower is too small to accommodate the revolving lens now installed in it. The tower stands one-eighth of a mile back from the point of the shore line and the light is partly obscured by trees on other properties. A new tower is required to be built farther out on the point. Coasting vessels bound north keep close inshore to avoid the prevailing northwesterly wind and sea, and a fog signal should be established here with quarters for two additional keepers. An improvement has been made in changing the light from fixed to flashing and an increase of intensity. The fog signal, as well as other improvements, and a new light tower, are necessary to render the aids efficient. Detailed estimate:

Tower, lantern, and fog-signal building.....	\$8,000
Fog-signal apparatus.....	7,000
Additional quarters.....	7,000
Improvements to present station.....	2,500
Contingencies.....	2,500
Total.....	27,000

No. 47. *Cape Spencer, Alaska, Light Station.*—For establishing a light and fog-signal station at or near Cape Spencer, Alaska, \$100,000.

NOTE.—Cape Spencer is at the entrance to Cross Sound and Icy Strait, through which pass all vessels running from Puget Sound ports to Prince William Sound, Seward, Cook Inlet, and Kodiak, excepting only occasional freighters proceeding by the outside route. With the construction of the proposed Alaskan railroad the traffic by way of Cape Spencer will be materially increased. A small unwatched light is now maintained on the cape, but it is believed that a large watched light and fog signal should be provided, especially for vessels returning from the westward, to be used as a landfall, as it is important that they be given all possible assistance, especially in thick weather. Maritime interests have urged the establishment of this aid. Detailed estimate:

Foundation.....	\$4,000
Buildings and tower.....	72,000
Illuminating apparatus.....	9,000
Fog-signal apparatus.....	6,000
Contingencies.....	9,000
Total.....	100,000

No. 48. *Potomac River, Md., aids to navigation.*—For improving the aids to navigation and establishing new aids on the Potomac River, Md., \$120,000.

NOTE.—The Potomac River, from Maryland Point to Washington, about 40 nautical miles, is now lighted only by 4 gas buoys, 5 minor lights, and 1 lighthouse. The gas buoys are of low candlepower and are of necessity removed from station for several months in winter on account of ice conditions. The minor lights are all fixed white or red lights of low candlepower, located on wharves or on timber structures, which are liable to destruction by ice in winter. Jones Point Light Station is of little use on account of changes in shore line at this point. It is proposed to establish 8 sets of flashing acetylene range lights and 7 or more flashing acetylene single lights, and to replace 15 of the present spar buoys by tall nun buoys more readily picked up at night. Jones Point Light Station and the 5 minor lights above mentioned may then be discontinued. Detailed estimate:

Purchase of sites for 10 lights.....	\$24,800
Towers for 10 lights on land, including foundation.....	14,300
Concrete structures for 6 lights on marine sites.....	28,200
Structures for 7 lights on land.....	4,900
Illuminating apparatus for 23 lights.....	32,700
Fifteen tall-type buoys and moorings.....	5,100
Contingencies.....	10,000
Total.....	120,000

No. 49. *Gas buoys, fifth lighthouse district.*—For the purchase of additional gas buoys for the improvement of aids to navigation in the fifth lighthouse district, \$52,000.

NOTE.—A number of deserving projects for the establishment of additional gas buoys should be provided for. Some of these have already received tentative approval, but funds have not been available for their establishment. Detailed estimate:

Thimble Shoal Channel, Va., 4 buoys.....	\$12,500
Beaufort Entrance, N. C.....	4,500
Tail of Horseshoe, Va.....	4,500
Slue Channel, Thimble Shoal, Va.....	3,000
Cape Lookout Breakwater, N. C.....	4,500
Elizabeth River, Va.....	3,000
Thirty-five Foot Channel, Va.....	4,500
Spring Garden Channel, Md.....	3,000
Relief buoys.....	13,000
Contingencies.....	500
Total.....	52,000

No. 50. *Portage Lake, Mich., aids to navigation.*—For establishing a light and fog-signal station upon a new site and improving aids to navigation at Portage Lake Ship Canals, Mich., \$100,000.

NOTE.—The War Department intends to remove the breakwater, and it is therefore necessary to rebuild the light and fog signal on a new site. The new light and fog signal should be established on a pier at the outer entrance, where it would be of the best service to vessels making the harbor. The construction of the station proposed will require considerable time to complete, and this project should have consideration for that reason. Detailed estimate:

Dredging, piling, and cribwork.....	\$15,000
Stone filling and riprap work.....	10,000
Concrete base with metal flashing.....	30,000
Superstructure.....	30,000
Fog signal and lighting equipment.....	9,000
Contingencies.....	6,000
Total.....	100,000

No. 51. *Ram Island, Me., light.*—For establishing a light on Ram Island, Lower Kennebec River, Me., \$3,100.

NOTE.—The need of this light has several times been expressed by petition. Ram Island is about 5½ miles below Bath, Me.; it is a low island in the middle of the river, with a string of half-tide ledges making off on the easterly side. There is a passage on either side, and at some stages of the tide a 5-knot current exists, from which several accidents have occurred. About 300,000 tons of freight and 175,000 passengers are transported past this island annually, not including the many pleasure craft and small boats which frequent the river. It is proposed to establish an acetylene light on or near the easterly side of Ram Island. Detailed estimate:

Light structure, including site.....	\$1,600
Illuminating apparatus.....	1,300
Contingencies.....	200
Total.....	3,100

No. 52. *Cape Kumukahi, Hawaii, Light.*—For establishing a light at or near Cape Kumukahi, Hawaii, \$22,000.

NOTE.—Cape Kumukahi is the easternmost cape of Hawaii. There is at present no landfall light for vessels bound to Hilo from the Panama Canal or from the southeast. It is a difficult point to round when sailing from Hilo to the south point or vice versa. A light on this point would be a great improvement to the lighting of the islands. The country in this vicinity is barren, undulating lava rock. An acetylene light is recommended, with a focal-plane height of about 150 feet, which would be visible about 20 miles. Landing from seaward at the cape is impossible at most times, and the only practical method of supplying

this station would be by railroad from Hilo to Kapoho and then by wagon road 3 miles to the cape, 1½ miles of which would have to be constructed over the rock. Detailed estimate:

Road.....	\$6,500
Tower, including site and right of way.....	9,300
Illuminating apparatus.....	4,000
Contingencies.....	2,200
Total.....	22,000

No. 53. *Henderson Point, Me., Light Station.*—For establishing a light and fog signal at or near Henderson Point, Piscataqua River, Portsmouth Harbor, Me., \$3,800.

NOTE.—The need of this aid has several times been expressed by petition. It is often very difficult to locate Henderson Point at night and in thick weather; the channel is narrow and there is a strong tide at this point, where the course changes. The commercial statistics for Portsmouth Harbor indicate about 5,600 vessels arriving and departing annually, transporting about 610,000 tons of freight. It is proposed to establish an acetylene light with fog bell. Detailed estimate:

Structures, including sites.....	\$1,800
Illuminating and fog-signal apparatus.....	2,000
Total.....	3,800

No. 54. *Port Real, P. R., Light Station.*—For establishing a light station at or near Port Real, P. R., \$40,000.

NOTE.—The lighthouse at Port Ferro, on the south coast of Vieques, or Crab Island, is one of the primary seacoast lights of the Porto Rican system. The light tower and the keepers' dwelling attached to it are built on top of a rocky promontory undermined for some time by the sea, and the whole structure, already dangerously cracked, is in danger of collapsing. It is urgent to rebuild a lighthouse at or near this point, as this is an important aid to the navigation from St. Thomas to Cuba and other West Indian Islands and the Caribbean Sea. A light in this vicinity is necessary for navigation, and it is proposed to dismantle the present Port Ferro Light Station and to erect a new light station at Port Real, about 3 miles westward where the aid will be more useful and on better ground than on its present location at Port Ferro, as Port Real is the most important and the best anchorage around Vieques Island. The present apparatus at Port Ferro is to be used for this new station. Detailed estimate:

Tower and dwellings for two keepers.....	\$30,000
Outbuilding and piping.....	1,500
Purchase of site.....	2,500
Roads and grounds.....	2,500
Contingencies.....	3,500
Total.....	40,000

No. 55. *Nine Mile Point, Mich., Light Station.*—For establishing a light and fog-signal station at or near Nine Mile Point, Mich., \$50,000.

NOTE.—When Forty Mile Point Light Station was established it was placed on the site designated Forty Mile Point on the county-survey charts. Sailing masters expected the station to be placed at Nine Mile Point, near the entrance to the Straits of Mackinac, but which was not so called officially then. While Nine Mile Point is within the visibility of Spectacle Reef and Poe Reef Light Vessel lights, a fog signal would be of especially great service in thick and foggy weather and during seasons when forest fires prevail. Not less than nine strandings occurred here between 1903 and 1909. In the event of establishing this station, Forty Mile Point could be made a minor light. Detailed estimate:

Tower.....	\$15,000
Illuminating apparatus.....	2,000
Fog-signal building and apparatus.....	9,000
Dwellings for three keepers.....	15,000
Outbuildings, boathouse, fences, etc.....	6,000
Contingencies.....	3,000
Total.....	50,000

No. 56. *Anacapa Island, Cal., Light Station.*—For establishing a light and fog signal at or near Anacapa Island, Cal., \$103,000.

Note.—Practically all coastwise vessels and a large number of those bound for Panama use the Santa Barbara Channel, and this traffic will be greatly increased with the opening of the Panama Canal. The desirable course leads close to the eastern end of Anacapa Island, which is now marked by a small beacon light, not sufficiently powerful to be of service in hazy weather. The American Shipmasters' Association has presented a petition for a light and fog signal, indorsed by the San Francisco and Los Angeles chambers of commerce and important shipping interests on the Pacific coast. It is therefore recommended that a light of high candlepower and a first-class fog signal be established at this point as soon as practicable. Detailed estimate:

Light tower.....	\$9,000
Illuminating apparatus.....	8,500
Fog-signal building and apparatus.....	14,000
Two sets double quarters for four keepers.....	24,000
Oil house, outbuildings, etc.....	6,000
Wharf, launch landing, and derrick.....	11,000
Roads, grading, and fencing.....	7,000
Water supply and sewerage system.....	14,000
Contingencies.....	9,500
Total.....	103,000

No. 57. *Caribbean Sea, aids to navigation.*—For establishing aids to navigation in the Caribbean Sea along routes leading to the Panama Canal, \$60,000.

NOTE.—The need for aids to navigation in the Caribbean Sea has become more urgent with the increase of traffic due to the Panama Canal, and such aids have been requested by the steamship companies using these routes. It is proposed to establish gas and whistling buoys at Farrall Rock (Gorda Bank), Southwest Cay (Serrana Bank), Formigas Bank, and Blower Rock (Pedro Bank), an unwatched acetylene light on the south end of Old Providence Island, and a first-class can buoy to mark the north end shoal of Old Providence Island. Detailed estimate:

4 gas and whistling buoys with moorings, etc., on station.....	\$26,000
2 gas and whistling buoys with moorings, etc., relief.....	13,000
1 first-class can tall type buoy.....	1,000
Tower in place.....	12,500
Illuminating apparatus.....	4,500
Contingencies.....	3,000
Total.....	60,000

No. 58. *Galveston Jetty Light Station, Tex.*—For improving Galveston Jetty Light Station, Tex., \$6,700.

NOTE.—The appropriation for this station is insufficient for the purchase and installation of a sufficiently powerful fog signal. It is recommended that a compressed-air fog signal be installed as soon as funds permit. Detailed estimate:

Compressors.....	\$4,000
Fog-signal apparatus.....	1,500
Piping and contingencies.....	1,200
Total.....	6,700

No. 59. *Grays Harbor Light Station, Wash.*—For improving Grays Harbor Light Station, Wash., \$10,000.

NOTE.—The present steam fog-signal plant at this station is located in a frame building. Both the machinery and building are quite old and in poor condition. It is proposed to construct a new fireproof building and install an electrically operated siren as soon as funds permit. Detailed estimate:

Fog-signal building.....	\$3,000
Purchase and installation of apparatus.....	7,000
Total.....	10,000

Total, group No. 2, \$1,581,600 (not included in total of estimates).

DESCRIPTIONS OF NEW WORKS COMPLETED.

The following are brief technical descriptions of important lighthouse works completed since the end of the fiscal year 1915:

OIL HOUSES FOR LIGHT STATIONS.

Purpose.—Isolated fireproof structures for the storage of kerosene and other inflammable supplies were erected at 4 light stations, in order to lessen the hazard of fire at such stations. These houses were constructed under allotments made from the balances existing under appropriations of \$10,000 each by the acts of May 27, 1908, March 4, 1909, and June 25, 1910. Details regarding each are shown in the following table:

District.	Station.	Site and structure.	Completed.	Cost.
3d.....	Dutch Island, R. I.....	Concrete house 13 by 15 feet.....	Apr., 1916	\$466
	Little Gull Island, N. Y.....	Concrete house 13 by 15 feet.....	June, 1916	460
	Watch Hill, R. I.....	Concrete house 13 by 15 feet.....	June, 1916	305
9th.....	San Juan Depot, P. R.....	Reinforced concrete carbide house...	Nov., 1915	215

STONINGTON LIGHT STATION, CONN.

Purpose.—The repairs to the seawall were carried out in order to protect the reservation on which the lighthouse stands.

Site.—The lighthouse reservation lies on Stonington Point, on east side of the harbor, Stonington, Conn.

Structure.—Stone wall around point of reservation was repaired and reinforced.

Cost.—The repairs were made under the act of March 4, 1911, appropriating \$500. The work was completed in November, 1915, by hired labor. Amount expended to June 30, 1916, \$499.37.

RONDOUT CREEK, HUDSON RIVER, N. Y.

Purpose.—This light station was established August 25, 1915, for the reason that a more efficient aid to navigation was required to mark the outer ends of the dikes forming an angle at the mouth of Rondout Creek and the Hudson River, shoals at this point having extended out so as to make the old Rondout Light of little use to mariners.

Site.—The station is located on a shallow submarine site inside the junction of the dikes, on the north side of Rondout Creek and west side of Hudson River, as stated above. A boring near the site showed mud overlying sand to a depth of 55 feet.

Structure.—The foundation of the structure consists of a reinforced concrete pier within a steel sheet cofferdam and resting upon wooden piles driven into the river bottom. A cavity at the top of the pier contains the cellar and cisterns. On top of this pier is located the tower and dwelling. The latter is two stories in height with an attic. Tower and dwelling are faced with vitrified brick and backed with hollow tile. The tower supports a fourth-order lantern, whose focal plane is 42 feet above top of pier. The building is equipped with a modern and complete plumbing and heating plant.

Illuminating apparatus.—The illuminating apparatus consists of a fourth-order lens, showing a fixed red light. The intensity of the light is 150 candlepower; the focal plane is 52 feet above mean high water, and the light is visible 9 miles in clear weather. The light is furnished by a fourth-order oil wick lamp.

Fog signal.—The fog signal consists of a 1,000-pound bell operated by clockwork.

Quarters.—There are quarters for one keeper with his family. The first floor contains sitting room, dining room, kitchen, and a large pantry; the second floor provides

three bedrooms, bathroom, and closets; third floor the attic, and the next is the watch-room floor. Supplies are landed at the station by a tender, a landing platform being provided for that purpose.

Cost.—The station was constructed under the act of March 4, 1911, appropriating \$40,000. It was constructed under two different contracts with the same company. The total cost was \$33,575.81. The work was commenced in March, 1914, and was completed in March, 1916.

ATCHAFALAYA ENTRANCE CHANNEL, LA.

Purpose.—To properly mark the recently completed dredged channel leading from the Gulf of Mexico through Atchafalaya Bay to the mouth of the Atchafalaya River, Point au Fer Reef Light and Fog-Signal Station and Atchafalaya Entrance Channel Lights Nos. 1, 3, 5, 7, and 2 were established on May 10 and 13, 1916. In addition to these aids, a number of gas-lighted buoys will be purchased and placed along this channel.

Site.—Point au Fer Reef Light and Fog-Signal Station is situated on Eugene Island on the westerly side of the dredged channel midway of its length. The island is 2 to 5 feet above mean high water and consists of shells and mud. The five beacon lights are on submarine sites about equidistant (with the main light) along the channel, the bottoms at all these locations consisting mainly of soft, sticky mud with sand.

Structures.—The structures consist of a light and fog-signal station, carbide house, boathouse, boat ways, wharf, etc., and five lighted beacons.

The light and fog-signal station consists of a wooden platform 32 feet square and 17 feet above mean high water, resting on 25 iron-cased, creosoted piles and supporting a story and a half frame dwelling surmounted by a square frame tower. This tower supports a fourth-order octagonal straight bar lantern whose focal plane is 36½ feet above the platform.

Of the five beacon lights, the two outside beacons consist of wooden platforms 20 feet square and 15 feet above mean high water, each resting on nine iron-cased, creosoted piles and supporting square pyramidal horizontally slatted structures. These structures support lens lanterns whose focal planes are 20 feet above the platform. The three inside beacons consist of wooden platforms 15 feet square and 12 feet above mean high water, each resting on 4 iron-cased, creosoted piles and supporting superstructures similar to those above; the focal planes of the lens lanterns are 25 feet above the platform.

Illuminating apparatus.—That for Point au Fer Reef Light Station consists of a fourth-order fixed lens giving a fixed white light. The intensity of the light is rated at 2,900 candles, the focal plane is 54 feet above mean high water, and the light is visible 13 miles in clear weather. A 35 mm., type B, 2-tank, incandescent oil-vapor lamp furnishes the light.

Those for the five beacon lights consist of the standard five-day lens lantern, showing fixed white lights. The intensity of the lights is rated at 160 candles. The focal planes are 35 feet above mean high water, and the lights are visible 9 miles in clear weather. Single-wick mineral lamps furnish the light in each case.

Fog signal.—This consists of a 1,000-pound bell located on the platform of Point au Fer Reef Light Station and struck by machinery one blow every 20 seconds.

Quarters.—The quarters for the three keepers are located at the main light on Eugene Island. The first floor, located on the platform, consists of a kitchen or living room, a bedroom, bathroom, and room for the fog-signal machinery. There are two bedrooms on the second floor. The single room on the third floor in the square tower is the watch room for the lantern. Two 1,500-gallon water tanks are located on the platform of the main light, and the latter is connected by a system of elevated walks with the oil or carbide house, boathouse, and wharf. Supplies are landed at the wharf from the tender.

Cost.—The station was established under the act of October 22, 1913, appropriating \$50,000. The total cost is \$39,320.40. The work which was carried out under contract was commenced in September, 1915, and practically completed in May, 1916. The gas-lighted buoys mentioned above and a motor boat will be placed in commission at a later date.

ASHLAND BREAKWATER, WIS.

Purpose.—This light and fog-signal station was established October 15, 1915, for the purpose of marking the outer end of the breakwater at Ashland, Wis. In making the harbor and docks at Ashland it is necessary to have the breakwater, which projects well out to form a protection for the harbor, properly marked.

Site.—The outer end of the breakwater as completed by the United States Engineer Office is a concrete pier on crib foundation resting on an earth fill with stone riprap all around. The tower is mounted on this pierhead. The dwelling, boathouse, and electric-control station are located on shore in the city of Ashland and slightly over 2 miles from the outer end of the breakwater. The dwelling is on two city lots and the boathouse on a submarine site on cribwork.

Structure (tower proper).—The foundation consists of a timber crib sunk on a dredged mud fill and filled with stone. On this crib which extends to about 2 feet below low-water level is placed a concrete pier superstructure on top of which the tower is carried centrally. The tower is hexagonal in plan and pyramidal in shape with a cylindrical watch room. The materials of walls are of reinforced concrete throughout except the watch room which is of steel. The first story of tower has vertical walls, the pyramidal section starting at the second floor level. In plan the base of tower is 21 feet over all, tapering to extreme dimensions of 13 feet 6 inches at the base of the watch room. The cylindrical watch room is surmounted by a fourth-order helical bar lantern, with a focal plane 55 feet above the top of the pier. All windows and doors in outside walls throughout are of steel. Partitions are of cement plaster on metal lath and floors are of reinforced concrete. Floors of all rooms except first floor and watch room are covered with a hardwood floor, secured to nailing strips in the concrete. The concrete floor of watch room is covered with a special floor covering. The outside walls are left natural concrete finish. Provision has been made in the base of the tower so that the entire superstructure can be releveled, should this ever become necessary, by means of hydraulic jacks. This precaution was taken owing to settlement that had been observed in the substructure prior to construction of the tower proper. Living quarters are provided in the second and third stories of tower, to be occupied in case of necessity. The pier is provided with a derrick for handling the keeper's launch.

Illuminating apparatus.—The illuminating apparatus consists of a fourth-order lens in which is located an automatic device carrying three 100-watt concentrated filament nitrogen filled lamps so arranged that one is in focus and the others arranged to be automatically substituted in case of breakage of filament of the one in use. The intensity of the light is about 1,600 candlepower, the focal plane is 65 feet above water level, and the light is visible about 16 miles in clear weather. The light is occulting showing flash two seconds, eclipse one second. Electricity obtained from the Ashland city power lines through a submarine cable about 2 miles long provides the illuminant and power for the fog signal.

Fog signal.—The fog signal is an electric siren located in the watch room and connected to city power, as for the electric light. Conditions locally are such that a signal of moderate range is sufficient and the electric siren seems well adapted to this location. Timing of both light and fog signal is accomplished from a control station located on shore where motor-driven electric sign flashers are used for the purpose. The power used at the siren is three-fourths horsepower, to which must be added considerable line loss in the cable. The characteristic is blast 4 seconds, silent interval 16 seconds.

Quarters.—A frame dwelling of five rooms for the one keeper at the station is located on a shore site in plain view from the lighthouse. All modern conveniences are provided, inasmuch as city conveniences are all at hand. The dwelling has a concrete basement, asbestos shingle roof, hardwood floors, and is conveniently located to the shore end of cable control station and boathouse.

Cost.—The station was constructed under the act of October 22, 1913, appropriating \$25,000. The total cost to June 30, 1916, was \$24,943.80. The work was done by hired labor and purchase of materials, commencing in December, 1913, and was completed in May, 1916.

AIDS TO NAVIGATION, ALASKA.

Purpose.—To meet the demands of the increasing commerce and to continue the work of establishing efficient aids to navigation, 29 acetylene lights and three oil lights on fixed structures were established at various points in Alaskan waters. Data relative to these lights are shown in tabular form on pages following.

Fog Signals.—There are none.

Quarters.—There are no quarters. These lights are all of the unwatched type, all but three using compressed acetylene in acetone, supplied from batteries of steel cylinders which contain a sufficient supply of gas to operate the light continuously between visits of the lighthouse tender.

Cost.—The appropriation of 1911 has been expended, and to June 30, 1916, the total expenditure from the appropriation of August 1, 1914, was \$50,433.62.

Name of light.	Locality.	Structure.	Top of lantern above ground, in feet.	Illuminating apparatus.	Characteristic.	Intensity of light, in candles.	Focal plane above mean high water, in feet.	Miles seen.	Approximate cost.	Date of establishment.
Akutan Harbor.....	Entrance to Akutan Harbor.	Small white wooden house.	10	Type B post lantern, burning oil.	Fixed white.	60	130	.....	\$85	July 20, 1915
Anchor Point.....	Cook Inlet.....	White-slatted wooden tripod.	21	Acetylene lens lantern.	Group flashing white (flash 0.5 sec., eclipse 1.5 sec.; flash 0.5 sec., eclipse 7.5 sec.).	130	41	9	1,820	Aug. 2, 1915
Barlow Islands.....	Saginaw Channel.....	Small white wooden house.	10	.....do.....	Flashing white (flash 0.5 sec., eclipse 4.5 sec.).	130	22	9	1,050	Oct. 24, 1915
Barren Island.....	Pixon Entrance.....	Small cylindrical house on skeleton tower.	59	.....do.....	.....do.....	130	70	9	4,890	June 30, 1916
Beck Island.....	Clarence Strait.....	Small white wooden house.	8	Type B post lantern, burning oil.	Fixed white.	60	20	7	.....	July 22, 1915
Clear Point.....	Lynn Canal.....	Small white wooden house.	10	Acetylene post light.	Flashing white (flash 0.2 sec., eclipse 1.8 sec.).	15	20	4	240	Oct. 25, 1915
East Chugach.....	Cook Inlet.....	.....do.....	10	Acetylene lens lantern.	Flashing white (flash 1 sec., eclipse 9 sec.).	160	325	9	3,000	July 2, 1915
East Foreland.....	.....do.....	Small white wooden house on white skeleton tower.	24	.....do.....	.....do.....	160	206	9	2,200	Aug. 6, 1915
Flat Island.....	.....do.....	Small white wooden house.	10	.....do.....	Flashing white (flash 0.5 sec., eclipse 4.5 sec.).	130	70	9	1,450	July 3, 1915
Hawk Inlet Entrance.....	Chatham Strait.....	Light on platform on trunk of tree.	19	Acetylene post light.	.....do.....	15	39	.....	210	Oct. 26, 1915
Hawk Inlet East.....	.....do.....	Five-pile red dolphin supporting wooden house.	.....	.....do.....	Flashing white (flash 0.2 sec., eclipse 1.8 sec.).	15	20	.....	420	Do.
Kingsmill Point.....	.....do.....	Small white wooden house on cylindrical pier.	10	Acetylene lens lantern.	Flashing white (flash 1 sec., eclipse 9 sec.).	130	25	9	1,420	Oct. 27, 1915
Lewis Reef.....	Tongass Narrows.....	Small white wooden house on cylindrical base.	23	Acetylene post light.	Flashing white (flash 0.2 sec., eclipse 1.8 sec.).	15	13	.....	860	Oct. 21, 1915
Little Island.....	Lynn Canal.....	Small white wooden house.	10	Acetylene lens lantern.	Flashing white (flash 0.5 sec., eclipse 4.5 sec.).	130	50	9	1,420	Oct. 9, 1915

Low Point.....	do.....	do.....	10	do.....	Flashing white (flash 1 sec., eclipse 9 sec.).	130	35	9	1,420	Oct. 8, 1915
Marmion Island.....	Gastineau Channel.....	do.....	10	do.....	Group flashing white (flash 0.3 sec., eclipse 0.9 sec.; flash 0.3 sec., eclipse 4.5 sec.).	130	40	9	1,520	Oct. 12, 1915
McClellan Rock.....	Peril Strait.....	Small white wooden house on cylindrical pier.	10	do.....	Flashing white (flash 1 sec., eclipse 9 sec.).	130	22	9	1,750	Sept. 30, 1915
Middle Point.....	Stephens Passage.....	Small white wooden house.	10	do.....	Flashing white (flash 0.3 sec., eclipse 2.7 sec.).	130	16	9	.....	Aug. 3, 1915
Molra Rocks.....	Clarence Strait.....	do.....	10	do.....	Flashing white (flash 0.5 sec., eclipse 4.5 sec.).	130	40	9	775	Apr. 29, 1916
Naked Island.....	Lynn Canal.....	do.....	10	do.....	Flashing white (flash 1 sec., eclipse 9 sec.).	130	40	9	1,420	Oct. 25, 1915
Narrow Point.....	Clarence Strait.....	do.....	10	do.....	do.....	130	35	9	1,420	Oct. 26, 1915
Ostioia Island.....	Peril Strait.....	do.....	10	do.....	Flashing white (flash 0.3 sec., eclipse 2.7 sec.).	130	17	9	1,410	Sept. 30, 1915
Point Alexander.....	Wrangell Strait.....	White wooden house on skeleton structure.	18	do.....	Group flashing white (flash 0.3 sec., eclipse 0.9 sec.; flash 0.3 sec., eclipse 4.5 sec.).	130	23	9	855	Nov. 20, 1915
Point Augusta.....	Chatham Strait.....	Small white wooden house.	10	do.....	do.....	130	45	9	1,525	Oct. 26, 1915
Point Gambier.....	Stephens Passage.....	do.....	10	do.....	Flashing white (flash 0.3 sec., eclipse 2.7 sec.).	130	30	9	1,420	Apr. 4, 1916
Point McCartney.....	Nichols Passage.....	Small white wooden house on skeleton tower.	18	do.....	Group flashing white (flash 0.5 sec., eclipse 1.5 sec.; flash 0.5 sec., eclipse 7.5 sec.).	130	50	9	1,250	Mar. 31, 1916
Point St. Albans.....	Sumner Strait.....	Small white wooden house.	10	do.....	Group flashing white (flash 0.3 sec., eclipse 0.9 sec.; flash 0.3 sec., eclipse 4.5 sec.).	130	45	9	1,270	Jan. 13, 1916
Race Point.....	Cook Inlet.....	do.....	10	do.....	Flashing white (flash 0.5 sec., eclipse 4.5 sec.).	130	190	9	1,400	Aug. 7, 1915
Rosa Reef.....	Tongass Narrows.....	do.....	10	Acetylene post light.	do.....	15	23	.....	225	Dec. 6, 1915
Rose Inlet.....	Tlevak Strait.....	Skeleton tower.	10	Type B post lantern, burning oil.	Fixed white.	60	23	.....	.....	July 19, 1915
Seal Rocks.....	On island, entrance to Resurrection Bay.	Small white wooden house.	10	Acetylene lens lantern.	Flashing white (flash 1 sec., eclipse 9 sec.).	300	285	11	2,375	June 23, 1916
Sheep Creek.....	Gastineau Channel.....	Small white wooden house on 4 piles.	.....	Acetylene post light.	Flashing white (flash 0.2 sec., eclipse 1.8 sec.).	15	20	.....	535	Oct. 13, 1915
Tenakee.....	Chatham Strait.....	Small white wooden house.	.....	Lens lantern, burning oil.	Fixed white.	160	20	9	.....	Aug. 16, 1915

SUMMARY OF IMPORTANT CONSTRUCTION AND REPAIR WORK UNDER GENERAL APPROPRIATIONS, COMPLETED DURING FISCAL YEAR 1916.

Station.	Cost.	Character of work.
SECOND DISTRICT.		
Cape Ann Light Station, Mass.....	\$4,371	Installation compressed-air fog signal in place of steam whistle.
Edgartown Light Station, Mass	2,221	Rebuilding footbridge.
THIRD DISTRICT.		
General Lighthouse Depot, N. Y.....	2,735	Dredging in and around basin, removing 15,145 cubic yards.
New London Depot, Conn.....	1,195	Renewing piles and repairing dock.
Coney Island Light Station, N. Y.....	3,238	Build riprap wall for protection of reservation.
Sea Girt Light Station, N. J.....	4,771	Grading and protecting site from erosion.
Tender Pansy.....	21,404	General repairs and alterations.
Light Vessel No. 16 (Relief).....	5,159	Various repairs and improvements, including a new steel forecastle deck, windlass, and boat davits.
Do.....	1,255	Repairs and improvements, including new oil and water tanks.
Light Vessel No. 44 (Northeast End)...	2,586	General overhauling and repairs.
Light Vessel No. 51 (Relief).....	3,293	Do.
Light Vessel No. 79 (Five Fathom Bank).	2,339	Repairs to boilers, installation of new circulating pump, and general repairs.
FOURTH DISTRICT.		
Bellevue Range Rear Light Station, Del.	3,179	Walk constructed from shore to tower.
Edgemoor Lighthouse Depot, Del.....	3,499	Concrete floor laid in storehouse.
Do.....	1,086	North retaining wall resheathed and concrete decking laid.
Listons Range Front Light Station, Del.	1,460	New lens installed.
Miah Maull Shoal Light Station, Delaware Bay.	1,325	New launch furnished.
FIFTH DISTRICT.		
Assateague Light Station, Va.....	4,055	New roof on dwelling, bathrooms installed and general repairs.
Portsmouth Lighthouse Depot, Va....	1,247	Raised the storehouse one story. Installed new bins, shelving, etc.
Currituck Beach Light Station, N. C..	1,710	Miscellaneous general repairs.
Cedar Point Light Station, Md.....	4,298	Concrete sea wall built.
Back River Light Station, Va.....	1,087	Installation of acetylene illuminating apparatus.
Watts Island Light Station, Va.....	1,078	Do.
SIXTH DISTRICT.		
Savannah River Lights, Ga.....	1,432	Repair of boat landings and board walks at minor lights and light stations on the Savannah River.
Charleston Light Station, S. C.....	1,169	Alteration and improvements to keeper's quarters, new plumbing fixtures, new cement sidewalks, and minor repairs.
St. Johns River Light Station, Fla....	1,668	New water supply, plumbing and drainage, repairs to fence, alterations and improvements to keeper's quarters, and minor repairs.
Jupiter Inlet Light Station, Fla.....	1,486	General repairs to dwellings and new tower windows.
SEVENTH DISTRICT.		
Big Marco Pass Light, Fla.....	1,743	Rebuilding structure and changing illuminant from oil to acetylene.
Coon Key Light, Fla.....	1,333	Establishing acetylene light on 4-pile wooden structure.
Egmont Key Depot, Fla.....	5,388	Replacing part of old wooden wharf with concrete dock.
Egmont Key Light Station, Fla.....	1,787	Constructing concrete walks, rearranging trees, and cleaning up grounds.
Do.....	1,794	Establishing fog-bell station in concrete house.
Key West Depot, Fla.....	3,531	General repairs to wharf.
Lakes Okechobee and Hicpochee Lights, Fla.	1,729	Establishing 18 post lantern lights.
Manatee River Cuts A and C Range and Cut D Range Lights, Fla.	3,626	Establishing 3 acetylene lens lantern lights and 2 oil lens lanterns.
Sand Key Light Station, Fla.....	4,855	Scaling and painting tower and dwelling, replacing defective bracing, installing reinforced concrete platform and stairs, and rebuilding wharf and landing.
Do.....	7,409	Improvements to illuminating apparatus, including cost of spare first-order fixed lens from the general depot.

SUMMARY OF IMPORTANT CONSTRUCTION AND REPAIR WORK UNDER GENERAL APPROPRIATIONS, COMPLETED DURING FISCAL YEAR 1916—Continued.

Station.	Cost.	Character of work.
EIGHTH DISTRICT.		
Deer Point Light, Fla.....	\$1,090	Rebuilding structure.
Mobile Ship Channel Lights and Cut-off Channel Beacon No. 2, Mobile Ship Channel, Ala.	2,957	General repairs to structures and wharf at Battery Gladden Light Station.
Sabine Bank East End Gas and Whistling Buoy, La.	4,665	Establishment of gas and whistling buoy.
Sabine Pass Gas and Whistling Buoy, La. and Tex.	5,100	Do.
Sabine-Neches Canal Lights Nos. 1, 3, 5, 7, 9, 11, Tex., Neches River Lights Nos. 2, 4, 6, 8, 10, Tex., Sabine River Light No. 2, Calcasieu-Sabine West Light, Calcasieu-Sabine East Light, La.	2,978	Establishment of 13 single-pile post lantern lights and 1 square 4-pile post lantern light.
Sabine and Neches Rivers, La. and Tex.	2,050	Establishment of 45 second-class spar buoys.
Bolivar Point Light Station, Tex.....	1,975	Jacking up keepers' dwelling and building temporary three-room house for assistant keepers.
Galveston Bay Channel Lights Nos. 4, 4A, and 6, Tex.	1,130	Repairing hurricane damage.
Texas City Channel Cut A Range, Cut B Outer Range, Cut B Inner Range Lights, and Texas City Channel Beacons Nos. 1, 2, and 4, Tex.	6,302	Establishment of six acetylene lantern lights and three single-pile day beacons.
Intercoastal canal lights between Galveston and Rockport, Tex.	5,917	Establishment of 120 daymarks along the Intercoastal Canal.
NINTH DISTRICT.		
Mayaguez Harbor Range Front Light, P. R.	2,500	Establishment of low-pressure acetylene light and generator house on reinforced concrete pile substructure.
Puntilla Point, San Juan Depot, P. R.	1,576	Riprap for shore protection.
Cucaracha Light, P. R.....	1,403	Establishment of a high-pressure oil-gas light and a reinforced concrete base.
Santa Elena Shoal Gas Buoy, P. R...	2,000	Establishing a gas buoy in place of an unlighted buoy.
Tourmaline Reef Gas Buoy, P. R.....	2,000	Do.
Gallardo Shoal Gas and Whistling Buoy, P. R.	2,150	Establishing a gas and whistling in place of a whistling buoy.
TENTH DISTRICT.		
Ballast Island, Ohio.....	2,475	Established acetylene light on 65-foot skeleton steel tower.
Boat No. 115.....	2,965	Built lighter 76 feet by 25 feet 6 inches by 6 feet 4 inches.
Braddock Point, N. Y.....	1,974	Removed face brick and laid new face brick on tower.
Buffalo Depot, N. Y.....	1,194	Replaced sheet-metal work where necessary on corrugated iron buildings; cleaned and painted buildings.
Cleveland East Entrance, Ohio.....	4,096	Installed electric light and fog signal.
Huron, Ohio.....	1,264	Laid sewer, connected city water, general repairs to dwelling and woodshed, and repaired elevated walk.
Linda Island, N. Y.....	2,400	Established acetylene light on 25-foot skeleton steel tower on concrete foundation.
Monroe, Mich.....	1,624	Provided and erected 25-foot skeleton steel tower and installed acetylene light in place of fourth-order oil light.
ELEVENTH DISTRICT.		
La Pointe Light Station, Wis.....	1,285	General repairs to station.
West Neebish Channel Light No. 20, St. Marys River, Mich.	2,492	Construction of new structure to replace that carried away by ice.
Saginaw River Range Light Station, Mich.	1,826	Rebuilding timber cribwork of front light in concrete and erection of steel tower. Electric light installation in both towers.
TWELFTH DISTRICT.		
Manistee South Breakwater Light, Mich.	2,125	Establishment of acetylene light on 31-foot standard skeleton steel tower.
Bank Point Light, Mich.....	2,637	Damage to light by ice repaired and 15-foot standard skeleton steel tower erected.
Racine Reef Light Station, Wis.....	3,631	Riprap protection to isolated pier of station.
Michigan City East Pierhead, Ind.....	1,661	Damage caused to station by storm of November, 1913, repaired.
Poverty Island Light Station, Mich...	1,850	Building landing crib, car track, etc., for delivery of coal and repairs to buildings.
Sheboygan South Breakwater, Wis....	1,875	Establishment of acetylene light on 31-foot standard skeleton steel tower.
Chicago Harbor, Ill.....	3,647	The compressed air 10-inch chime whistle replaced by steam boilers and 12-inch whistle.

SUMMARY OF IMPORTANT CONSTRUCTION AND REPAIR WORK UNDER GENERAL APPROPRIATIONS, COMPLETED DURING FISCAL YEAR 1916—Continued.

Station.	Cost.	Character of work.
TWELFTH DISTRICT—continued.		
Milwaukee Lighthouse Depot, Wis....	\$3,386	Electric lights installed, new bins and shelving, etc., installed in warehouse.
Twin River Point, Wis.....	1,029	Deepening well, renewing walks in concrete, and repairs and improvements to buildings.
Tender Hyacinth.....	5,531	Improvements to quarters, repairs to hull, boilers, and machinery.
Tender Sumac.....	2,446	General repairs to decks, etc., and fire-hold floor, overhauling and repairs to boilers and machinery.
Grays Reef Light Vessel, No. 56.....	6,520	General rebuild, wooden vessel.
Eleven-foot Shoal Light Vessel, No. 60.	2,859	General repairs to decks, etc., and new compact marine boiler for fog-signal purposes.
SIXTEENTH DISTRICT.		
Cape Sarichef Light Station, Alaska...	2,425	Installed hoisting engine, new fog horns, and made minor repairs.
Cape St. Elias Gas, Whistling, and Submarine Bell Buoy, Alaska, with relief buoy.	11,775	Gas, whistling, and submarine bell buoy established.
Dewey Rocks Light, Alaska.....	3,713	Reestablished acetylene light on structural steel tower.
Scotch Cap Light Station, Alaska.....	3,484	Installed tram and hoisting engine, built shore protection, and made minor repairs.
SEVENTEENTH DISTRICT.		
Robinson Point Light Station, Wash..	11,239	Concrete light and fog-signal building erected; fog signal changed from steam to compressed air; and a fourth-order group flashing light installed in place of lens lantern.
Do.....	1,250	General repairs to walks, grounds, and keepers' dwelling, a new well, and removal of pump house thereto.
Tongue Point Lighthouse Depot, Oreg.	3,659	Installation of compressed-air plant and electric power and lighting system. Overhauling and modification of machine shops.
Acetylene high-pressure buoys.....	6,282	Four buoys were converted to high-pressure acetylene type, and necessary gas tanks purchased.
EIGHTEENTH DISTRICT.		
Point Sur Light Station, Cal.....	1,707	Installation of concrete gathering and settling tanks and 9,000-foot line for water supply.
Pigeon Point Light Station, Cal.....	1,711	Construction of a 60,000-gallon reinforced concrete water reservoir.
Piedras Blancas Light Station, Cal....	2,379	Lens modernized by rearrangement of panels, and ball-bearing chariot wheels installed.
Goat Island Depot, Cal.....	1,068	Steel piles under wharf chipped, sand-blasted, and painted. Sea wall filled in to repair storm damage.
Do.....	1,689	Repairs and improvements to wharf, quarters, sea wall, fence, etc.
NINETEENTH DISTRICT.		
Cocoanut Point Light Station, Hawaii.	1,710	Old tower with electric light replaced by reinforced concrete tower with acetylene flashing light.
Kuhio Bay Range Lights, Hawaii.....	2,596	Electric range lights established.
Makapuu Point Light Station, Hawaii.	1,189	General repairs to roadway and station.
Molokai Light Station, Hawaii.....	1,362	General repairs to station.

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ANNUAL REPORT

OF THE

COMMISSIONER OF LIGHTHOUSES

TO THE

SECRETARY OF COMMERCE

FOR THE

FISCAL YEAR ENDED JUNE 30, 1917



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REPORT

OF THE

COMMISSIONER OF LIGHTHOUSES.

DEPARTMENT OF COMMERCE,
BUREAU OF LIGHTHOUSES,
Washington, September 15, 1917.

SIR: The following report is submitted of the operations of the Lighthouse Service for the fiscal year ended June 30, 1917:

ORGANIZATION OF THE LIGHTHOUSE SERVICE.

The general organization of the Service remained unchanged during the fiscal year.

AIDS TO NAVIGATION.

During the fiscal year ended June 30, 1917, there was a net increase of 275 in the total number of aids to navigation maintained by the Lighthouse Service. There was an increase of 5 fog signals, 33 lighted buoys, 189 unlighted buoys, and 62 minor lights (including 12 float lights).

Fixed lights were changed to flashing or occulting at 39 stations. The illuminant of 17 lights (including 1 light vessel) was changed to incandescent oil vapor, the illuminant of 26 lights (including 4 light vessels) was changed to acetylene, the illuminant of 13 lights was changed to electric incandescent, and the illuminant of 1 light was changed to oil gas.

On June 30, 1917, there were maintained by the Lighthouse Service 15,223 aids to navigation, including 5,420 lights of all classes and 588 fog signals (not including 81 whistle and 241 bell buoys), of which 51 are submarine signals. It is believed that the systematic methods of improvement and the use of modern apparatus in increasing the number and brilliancy of aids have been of value to the safety of commerce.

The table following gives a summary of the aids to navigation, under each class, established and discontinued during the fiscal year, and also the net increase, and the number in commission at the end of the fiscal years 1916 and 1917.

Class.	1917			Total, June 30—	
	Estab- lished.	Discon- tinued.	In- crease.	1916 ^a	1917.
Lighted aids:					
Lights (other than minor lights).....	39	39		1,708	1,708
Minor lights.....	185	135	50	2,920	2,970
Light-vessel stations.....				53	53
Gas buoys.....	73	40	33	512	545
Float lights.....	23	11	12	132	144
Total.....	320	225	95	5,325	5,420
Unlighted aids:					
Fog signals.....	8	3	5	532	537
Submarine signals.....		1	^b 1	52	51
Whistling buoys, unlighted.....	4	6	^b 2	83	81
Bell buoys, unlighted.....	8	5	3	238	241
Other buoys.....	375	186	189	6,657	6,846
Day beacons.....	96	110	^b 14	2,061	2,047
Total.....	491	311	180	9,623	9,803
Grand total.....	811	536	275	14,948	15,223

^a Differences from statistics published in 1916 report are due to minor discrepancies in previous count.

^b Decrease.

The following are some of the more important aids which have been established or materially improved during the past fiscal year:

A new third-order light station with a flashing white oil-vapor light and a first-class air siren was placed in commission at Cape St. Elias, Kayak Island, Alaska.

A new light vessel, *No. 101*, was established off Cape Charles, Va., in place of the old vessel, *No. 49*, and a new light vessel, *No. 102*, took the place of old *No. 43* at Southwest pass entrance to the Mississippi River, La.

The illuminating apparatus on Brunswick Light Vessel *No. 84*, Ga., was improved by changing from two fixed white to one flashing white light, and a similar change was made on Handkerchief Light Vessel *No. 3*, Nantucket Sound, Mass.

Fog signals were established at Eagle River Shoals, Lake Superior, Mich. (electric siren); Manistique, Mich. (air diaphone); Sheboygan Breakwater, Lake Michigan, Wis. (first-class air siren); and Cleveland West Pierhead, Ohio (air diaphone). Four air diaphones were installed on the Pacific coast in place of sirens or whistles at the following stations: Scotch Cap, Unimak Pass, Alaska; Cape Flattery, Tatoosh Island, Wash., Farallon and Point Conception, Cal.

Important lighted buoys were established at The Graves, Boston Harbor, Mass. (whistle); Popasquash Point, Narragansett Bay, R. I. (bell); Conaskonk Point Shoal, Raritan Bay, N. J.; Bulkhead Shoal Channel, Delaware River, Del. (3 buoys); Sewall Point Shoal, Hampton Roads, Va. (bell); Caucus Cut Entrance, Pensacola Bay, Fla. (whistle); Mobile Bay Entrance, Ala. (4 buoys, 1 with whistle); Brazos River Entrance, Tex. (2 buoys, 1 with bell); Manchas Grandes, Mayaguez Harbor, P. R.; Gravelly Island Shoal, Lake Michigan, Mich. (bell); Outer Shoal, Lake Michigan, Wis. (bell); Orca Inlet (2 buoys) and Reef Island Reef, Prince William Sound, Alaska; Poundstone Rock, Favorite Channel (bell), and Channel Rock, Sitka Sound, Alaska; Duwamish Head, Seattle Harbor, Wash. (bell); and Grays Harbor Outside Bar, Wash. (whistle).

Systems of minor aids and buoyage were extensively rearranged or improved in the following important localities: Sand Shoal and Smith Island Inlets and Magothy Bay, Va.; Caximbas Pass, Fla.; Mobile Bay, Ala.; Houston Channel, Tex.; Tonowek Bay, Karheen Passage, and Zimovia Strait, Alaska; and San Diego Bay, Cal.

Flashing acetylene lights were established at Hunts Point, East River, N. Y.; Delaware City, Del.; Rancocas River Range, N. J. (2 lights); Fishing Point, Assateague Anchorage, Va.; Lower Cedar Point Beacon, Port Tobacco River Flats, and Persimmon Point Shoal, Potomac River, Md.; Tunnel Island Spit, Va.; Bull Spit, Fenwick Island Cut, Marsh Island Spit, and Steamboat Creek, S. C.; Two Harbors West Breakwater, Lake Superior, Minn.; Tonawanda Channel Range, Niagara River, N. Y. (2 lights); Fighting Island, Detroit River, and Portage Lake Pierhead, Mich.; San Diego Bay, Cal.; Cape Edwards Entrance, Hanin Rocks, Kodiak Harbor, Alaska; Kukii Point, Kauai Island, and Kipahulu, Maui, Hawaii.

The beginning of lighthouse work in America was commemorated in Boston, Mass., on September 25, 1916, when a bronze tablet was unveiled at Boston Light Station, on the two-hundredth anniversary of its establishment. The Secretary of Commerce was present on the occasion and a number of Federal, State, and municipal officers, as well as representatives of commercial, maritime, and historical organizations of Boston. A full account of this celebration was published as a special bulletin of the Lighthouse Service.

The Gulf coast again suffered from three tropical hurricanes during the fiscal year, the same as last year. These storms occurred on July 5, 1916, in the general vicinity of Mobile, Ala.; on August 18, 1916, near Aransas Pass, Tex.; and on October 18, 1916, around Pensacola Bay, Fla. The July storm was by far the most severe and damaged property of the Lighthouse Service to the extent of about \$140,000. Congress, by the act of September 8, 1916, appropriated \$125,000 to repair this damage. The aggregate damage of the August and October storms was about \$60,000. No lives of persons in the Lighthouse Service were lost in any of these storms.

Ice conditions during February, 1917, were unusually severe in the North Atlantic coast districts, and many aids to navigation, as well as lighthouse vessels, were damaged, particularly in Buzzards Bay, Mass.; New York Bay, N. Y. and N. J.; Delaware Bay, N. J. and Del.; and Chesapeake Bay and tributary waters, Maryland and Virginia.

For the general assistance of persons navigating in motor boats and other small craft, the Department issued a card with illustrations showing various types of buoys and brief rules regarding their colors and numbers, along with the distances of visibility for objects of stated elevations above sea level.

In furtherance of the project for the improvement of coastal communication facilities, and as a result of the inquiry referred to in last year's annual report, the United States Coast Guard is preparing to install telephone service at about 75 light stations on the Atlantic, Gulf, and Pacific coasts.

ALASKA.

The total number of aids to navigation in Alaska, including lights, gas buoys, fog signals, buoys, and daymarks, in commission at the

close of the fiscal year ended June 30, 1917, was 416, including 152 lights and 7 gas buoys, representing an increase of 122 lighted aids since June 30, 1910, or 330 per cent. The following table, which gives the total number of aids to navigation on June 30 of each year named, illustrates the progress in establishing aids in the Territory:

Aids.	1910	1911	1912	1913	1914	1915	1916	1917
Lights.....	37	71	85	93	108	112	147	152
Gas buoys.....								7
Fog signals.....	9	10	10	10	10	10	11	11
Submarine bell.....								1
Buoys.....	84	105	132	136	157	167	181	189
Daymarks.....	50	29	98	40	44	49	49	56
Total.....	160	215	265	279	319	338	388	416

The light and fog-signal station at Cape St. Elias, for which an appropriation of \$115,000 was made by the act of October 22, 1913, was completed during the year and lighted for the first time on September 6, 1916. Within a few weeks after its establishment a master of a passing merchant vessel reported that reflections of the light were visible at a distance of 37 nautical miles on a cloudy night with heavy rain squalls and a rough sea.

The appropriation of \$60,000 made by the act of August 1, 1914, for aids to navigation in Alaska has been practically expended after providing needed improvements at about 40 places. A further appropriation of \$60,000 was made for the same purpose by the act of June 12, 1917. Work on this project was started at once, and good progress has been made up to the date of this report.

The new lighthouse tender *Cedar*, for which \$250,000 was appropriated by the act of January 25, 1915, was practically completed during the fiscal year, except for a few minor items, and sailed from Long Beach, Cal., on July 11, 1917, for assignment to Alaskan duty. The tenders *Kukui* and *Fern* have been assigned to the Alaska district during the year.

GUANTANAMO, SAMOA, AND GUAM.

The aids to navigation in the outlying United States territory at Guantanamo Bay, Cuba, the American Samoan Islands, and the island of Guam are maintained under the supervision of the naval commandants by means of allotments made from the appropriations for the Lighthouse Service. Reports have been received from naval officers in local charge indicating that the aids have been properly maintained, at an approximate annual expense as follows: Guantamo, \$4,190; Samoa, \$920; Guam, \$700.

In addition to the duty of maintaining the aids to navigation, the commandant of the naval station at Guantanamo Bay continued to render valuable assistance to the Lighthouse Service by his cordial cooperation in connection with lighthouse-construction work at Navassa Island, West Indies, which is remote from any other United States possession.

VIRGIN ISLANDS.

The lighthouse work in the islands of St. Thomas, St. Croix, and St. John, with the outlying rocks and islets, formerly constituting the Danish West Indies and now the Virgin Islands of the United

States, was by Executive order dated July 20, 1917, placed under the Lighthouse Service, following the customary procedure in such cases. In the portion of this report devoted to financial matters the detail of an estimate of \$50,000 to carry out this work is submitted.

ENGINEERING AND CONSTRUCTION.

New works of principal importance under special appropriations completed during the fiscal year are as follows: New carpenter shop at the general depot, Tompkinsville, N. Y.; Charleston depot, Charleston, S. C.; Manistique lights and fog signal, Michigan; and Cape Saint Elias light and fog signal, Alaska.

Other important work in progress at the close of the fiscal year includes: Dog Island Light, Me.; Woods Hole depot improvements, Massachusetts; aids to navigation, Hudson River, N. Y.; aids to navigation, Delaware River, Pa. and Del.; aids to navigation, St. Johns River, Fla.; additional lights, Florida Reefs, Fla.; lighting Mississippi River below New Orleans, La.; repair of hurricane damage, Gulf of Mexico; Navassa Island light station, West Indies; and aids to navigation at Ashtabula, Cleveland, and Lorain, Ohio.

The most important item of construction work completed during the year was the new Cape St. Elias light station, Alaska, to which reference has previously been made. This light is of 300,000 candle-power and forms the landfall for vessels bound to Prince William Sound or Cook Inlet from either the Pacific coast of the United States or southeastern Alaska.

A large amount of construction work was also performed in the Gulf of Mexico districts, repairing hurricane damage. Care was taken to give the new structures increased strength and rigidity, within the limits of available funds, to avoid such destructive effects in future as far as possible.

A standard form of map and instructions for surveys of lighthouse reservations was prepared and issued during the year, to insure future uniformity in such work.

The standard plans and specifications for helical-bar lanterns were revised during the year, with the principal object of affording increased ventilation where oil-vapor lamps are employed.

A general inquiry as to the efficiency of all unprotected reinforced-concrete structures of the Service located upon submarine sites was instituted during the year, with the object of studying possible deterioration of such structures in sea water and the best means of overcoming any difficulties encountered.

IMPROVEMENT OF APPARATUS AND EQUIPMENT.

Floating beacons, designed for emergency use in replacing minor lights in inside waters carried away by ice or damaged by collision, pending the reconstruction of the permanent light, have been built and tested in service with satisfactory results.

A bell float for use in very shoal water has also been designed and tried out. It is reported to give efficient service, the bell ringing almost continuously, even in calm weather.

Experiments have been conducted at the general depot with a view to the manufacture of 375-millimeter (about 15 inches) pressed-glass buoy lenses for use in place of the present expensive cut-glass lenses.

Practical tests, by actual visual observation and by the photometer, indicate that almost equal efficiency can be obtained by the use of pressed-glass lenses, at a cost of about 40 per cent of the former cut-glass lenses, and as a result pressed-glass lenses have been adopted for future use in all 375-millimeter lanterns.

The extension of incandescent oil-vapor lamps to fifth-order lenses has been made with success. It was previously the impression that on account of the small size of the fifth-order lens damage to the prisms might occur from the intense heat of the oil-vapor lamp, but it was found by the use of a metal deflector in the upper portion of the lens the prisms were protected from cracking, without material loss in the resulting efficiency of the light. A six-months' service test of such an installation proved satisfactory.

A committee composed of representatives of the Navy Department and Department of Commerce, including the Lighthouse Service, has been appointed to consider and report on the further use of radio apparatus for fog-signal purposes and to coordinate experimental work along the lines now in progress, and various tests are being made.

Occulting blinds for lights have been designed and manufactured at the general depot. These consist of a frame placed in front of the lens carrying vertical shutters that may be rotated by connecting rods. The rods are actuated through links connected with a cam on the operating clock, and the mechanism is so arranged as to give a practically instantaneous opening and closing of the shutters.

Kerosene for fuel, replacing coal, was in use in the galley range aboard several vessels with good results and has been found more satisfactory than coal. The systems installed consisted of a standard-type outfit as used for oil-vapor lamps, with a starting torch and the necessary accessories, including also specially arranged fire brick.

A new type of post lantern with an automatically occulting light, designed in the Bureau, is now being tested and gives promise of furnishing an improvement.

The continued use of oil engines in place of steam for power and for operating fog signals has demonstrated the greater economy and convenience of such apparatus, and the use of these engines is being extended as boilers now in service become unfit for further use.

A thermostat designed to warn keepers by ringing a bell when undue fluctuations occur in operating oil-vapor lamps has been developed and issued to a number of stations, where it has been found that such thermostats are of benefit to the proper maintenance of the lights.

In the case of a new fog-signal installation a double-mouth cast-iron horn was used in place of the usual sheet-copper horn, effecting an improvement, as it directs the sound equally well, is more durable than the copper horn, and greatly reduces the reflection of sound on the station in back of the horn.

A new type of gas and whistling buoy, of practically the same size as the type L now in use but with the addition of a whistle, has been designed at the general depot. It is believed this will give a buoy of suitable size for channel work and other locations where a larger type would be too heavy.

The work of standardization has been extended during the past year as heretofore, and in many cases articles and parts have been completely standardized and are now interchangeable, so that repair parts may be kept on hand for issue at short notice. Work has also been started on small drawings of such parts, on letter-size sheets so arranged as to bind in book form for distribution to the district offices, facilitating identification and reference.

In the river districts service tests have been made with various types of lantern brackets for lighted buoys and also with various modifications of the barrel body of buoys now in use. It was proposed also to give metal buoys a trial, but the scarcity of material and prevailing prices will make these prohibitive, except for special tests, for the present.

PERSONNEL.

The following table gives the number of employees (all authorized positions, including some vacancies) of the Lighthouse Service at the end of the fiscal year and a comparison of the totals with those for the previous fiscal year:

EMPLOYEES IN THE LIGHTHOUSE SERVICE ON JUNE 30, 1917.

District.	Inspectors, engineering force, drafts-men, aids, appointed foremen, and mechanics.	Clerks, messengers, janitors, and office laborers.	Depot keepers and assistants, including laborers.	Light keepers and assistants.	Laborers in charge of lights (appropriation "Salaries, keepers of lighthouses").	Laborers in charge of post lights and buoys (appropriation "General expenses").	Custodians of reservations.	Officers and crews on tenders and light vessels.	Field force for construction and repair (registered).	Field force for construction and repair (unregistered).	Total.
Bureau.....	14	25									39
First.....	3	6	1	113	2			70	3	9	213
Second.....	4	7	2	78	11			216	2	6	326
Third.....	22	30	17	180	32	56	2	279	173	44	840
Fourth.....	11	5	3	54	6	5	6	29	5	4	122
Fifth.....	11	9	34	173	93	20	1	257	6	6	610
Sixth.....	5	7	2	55	9	26		128	3	18	253
Seventh.....	11	3	1	41	1	1		31	4	14	104
Eighth.....	7	9	16	109	29	34		115	9	41	369
Ninth.....	2	5	1	34	5			24	16	6	93
Tenth.....	8	5	2	65	1		1	33	5	13	133
Eleventh.....	8	6	6	158	10	2	2	110	16	6	324
Twelfth.....	7	6	5	154	18	2	1	93	6	5	297
Thirteenth.....	1	2				323		17			343
Fourteenth.....	1	2				539					542
Fifteenth.....	1	2				372		20			395
Sixteenth.....	5	5	1	32		18		45	1	8	115
Seventeenth.....	6	6	4	79	15	117		121	5	2	355
Eighteenth.....	6	6	7	111	8	5		91	6	13	253
Nineteenth.....	4	3	1	27	2			25	3	5	70
Total, 1917.....	122	149	103	1,464	242	1,526	13	1,704	273	200	5,796
Total, 1916.....	123	147	69	1,473	241	1,524	12	1,592	270	340	5,791
Increase.....		2	34		1	2	1	112	3		5
Decrease.....	1			9						140	

ADMINISTRATION METHODS AND ECONOMIES.

A fourth annual conference of lighthouse inspectors, authorized by the Secretary of Commerce, was held during January, 1917. The program followed the previous general lines, and the results are believed beneficial to the Service.

A compilation of data relating to coal used as fuel for the Service was made, indicating the consumption for the fiscal year 1916 to be about 58,000 tons of bituminous and 9,600 tons of anthracite coal.

A compilation of data relating to hours of fog and its relative prevalence at different seasons of the year was made from information on file, based on the regular records at fog-signal stations. Records of fog have been kept in a systematic manner since 1885 and are now sufficiently complete to provide material for study of this matter from both meteorological and engineering standpoints.

Careful attention was given during the fiscal year both by the Department and the Bureau to conditions affecting pay and subsistence, particularly on board vessels. In order to bring about as uniform conditions as the widely different character of the work of the several maritime bureaus and the Service might permit, the Department authorized a marine board, on which the Lighthouse Service is represented, to consider such problems. A more detailed statement in reference to this question appears in another portion of this report.

The Lighthouse Service took part with other bureaus of the Department at the Southern Commercial Congress held in Norfolk, Va., during December, 1916; and a small exhibit illustrating various types of structures and apparatus was shown at the annual meeting of the Chamber of Commerce of the United States held in Washington, D. C., during January, 1917. The Service was also awarded a gold medal at the Panama-California International Exposition held at San Diego, Cal., during 1916.

With a view to saving the frequent expense of obtaining telegraphic authority, the Department authorized a regulation permitting inspectors to assign suitable persons to duty, under civil-service rules, in cases of death, sickness, or other circumstances where immediate filling of a position is necessary for the proper safeguarding of life and property, with the understanding that the circumstances must be promptly reported by mail.

In order to reduce paper work entailed by reports of officers detailed from one vessel to another for short periods of duty, the Department authorized inspectors to make such details for one month or less without the necessity of obtaining prior authority or reporting the case specially.

Following a suggestion of the Secretary of Commerce, measures were taken to urge all persons on lighthouse reservations to cultivate as much land as possible for growing foods.

The Secretary also suggested a canvass be made throughout the Service relative to subscriptions to the First Liberty Loan Bonds authorized during the year, with the result that 1,066 persons in the Service purchased these bonds to the total amount of \$230,750.

The compilation of a corrected list of lighthouse reservations, mentioned in last year's report, has been completed, showing a total of 1,132 reservations of land owned by the Service, amounting in all to about 134,000 acres.

Systematic inspections of the various lighthouse districts by the general inspector, examiner, and other officers of the Bureau were continued as in former years with satisfactory results.

The standard method of cost keeping was continued as usual, and a general summary of results is given under a separate head.

The Department gave attention during the year to various suggestions offered in the way of saving of paper and other office supplies, and, as a result of these, issued supplemental instructions governing such matters, which have resulted in substantial economies. These embraced the use of half-sheet letter heads, lighter grades of paper, single-spacing of typewritten letters, use of spare paper for scratch pads, etc.

The Bureau also introduced a number of economies in printing, with the assistance of the Division of Publications, so that the expense of printing for the Service during the fiscal year was reduced to 85 per cent of the allotment made for the purpose by the Department.

As a result of tests made at the general depot to determine the relative value of turpentine and "petroleum spirits" in varnishes, it was found that while turpentine was slightly superior the difference was not sufficient to warrant the large excess in price at the present time, and, therefore, instructions were issued to carry petroleum spirits in stock for further service trial.

A special form of pay roll to be used in connection with the 5 and 10 per cent increase in compensation authorized by Congress for persons receiving \$1,800 or less was prepared and issued, to facilitate the handling of this matter by district offices.

COST-KEEPING SYSTEM AND RESULTS.

A standard method of cost keeping has been continued in effect throughout the fiscal year, and reports have been received from all the districts, in which itemized costs of each office, depot, light and fog-signal station, tender, and light vessel are shown separately. The costs of minor lights, daymarks, and lighted and unlighted buoys are shown in groups by various districts, each type of aid to navigation being accounted for separately. In all cases the costs are divided into main headings—maintenance and betterments. The cost of maintenance includes what may be considered fixed charges, such as salaries, rations, fuel, and general expendable supplies. The item of betterments includes repairs, improvements, and new construction, and is further subdivided to show the cost of labor and materials separately for each principal object.

The costs are based on the actual expenditures during the fiscal year, whether of money or supplies. They are checked with the money accounts by taking into consideration the actual cash expenditures and the difference in the value of supplies on hand at the beginning and at the end of the year. The information from this cost-keeping system is useful in preparing estimates, planning work, effecting economies, and comparing the efficiency of different districts, vessels, light stations, apparatus, methods, etc.

A generalized summary of costs for the fiscal year ended June 30, 1917, follows, as derived from this cost-keeping system. Overhead charges, offices, depots, and tender service are stated as separate features in this summary and are not distributed nor included in the costs of aids to navigation. Notwithstanding the most careful and painstaking efforts to economize in every direction, the recent extraordinary advance in the price of labor and materials is clearly shown in the increased costs reported for practically all features.

SUMMARY OF COSTS, LIGHTHOUSE SERVICE, FISCAL YEAR ENDED JUNE 30, 1917.

[Amounts are stated to nearest even dollar, causing occasional minor discrepancies in totals. Difference from total expenditures reported elsewhere is due to inclusion of Bureau salaries, printing expenses, and adjustment of inventories of articles furnished from stock.]

TOTAL COSTS OF PRINCIPAL FEATURES.

Feature.	Maintenance expenses.				Betterment expenses.				Grand total.	Per cent.	
	Salaries.	Subsistence.	General supplies.	Incidental expenses.	Total.	Repairs and improvement.					Total.
						Labor.	Materials and supplies.	New works.			
Administration a.....	\$330,660	.....	\$49,897	\$1,338	\$381,895	.....	.....	.....	\$381,895	6
Distributive charges b.....	866,961	\$206,800	486,296	27,999	1,588,065	\$149,248	\$158,982	\$207,001	\$515,781	36	
Aids to navigation c.....	1,510,605	255,909	479,523	16,913	2,263,043	280,863	372,953	484,593	1,138,409	28	
Total.....	2,708,226	462,806	1,015,716	46,250	4,233,003	430,111	531,885	692,194	1,654,190	100	

TOTAL COSTS OF DETAILED FEATURES.

Offices.....	\$330,660	.....	\$72,992	\$1,338	\$404,990	.....	.....	.....	7
Depots.....	191,224	.....	82,664	21,972	296,860	\$31,079	\$40,761	\$48,798	8
Tenders:									
Large.....	188,017	\$55,889	129,085	1,947	374,936	14,805	14,806	78,712	8
Medium.....	454,321	137,761	233,449	3,729	829,328	97,313	97,314	61,703	18
Small.....	33,399	13,159	18,003	351	64,912	6,051	6,052	18,388	2
Total.....	675,737	206,809	380,537	6,027	1,269,176	118,169	118,171	158,803	28
Light vessels:									
Exposed.....	164,488	39,898	44,868	587	249,840	40,014	40,015	.....	5
Moderately exposed.....	96,654	27,331	19,581	146	143,714	11,971	11,971	80,470	4
Relief.....	61,085	16,076	22,007	198	99,365	23,719	23,719	.....	3
Lakes.....	45,486	13,092	11,726	186	70,493	12,270	12,271	28,533	2
Total.....	367,713	96,397	98,182	1,117	563,412	87,974	87,976	109,003	14
Total.....								284,953	
								848,806	

Light stations: First order..... Second order..... Third order..... Three and one-half order..... Fourth order.....	114,436	19,948	36,159	2,004	172,547	13,116	18,580	145	31,841	204,388	3
	50,373	8,883	17,884	386	77,526	4,351	7,888	9,174	21,413	98,939	2
	99,405	20,548	42,613	2,764	165,380	13,484	16,718	37,537	67,720	233,059	4
	21,539	4,072	5,956	58	31,625	3,283	8,363	442	12,088	43,713	1
	337,111	64,432	99,694	2,873	504,110	54,247	72,251	146,672	273,170	777,290	13
Total.....	622,864	117,883	202,306	8,085	951,138	88,481	123,800	193,960	408,241	1,357,379	23
Minor fixed aids: Fifth order..... Sixth order..... Lens lanterns..... Post lights..... Other lights..... Daymarks, etc.....	85,963	17,180	17,696	531	121,370	14,510	19,428	.....	33,938	155,308	3
	42,497	7,812	10,919	26	61,254	3,532	4,339	527	8,398	69,652	1
	67,222	8,034	11,747	476	87,479	6,486	8,238	64,745	79,469	166,948	3
	215,520	.....	19,522	630	235,672	2,550	12,184	2,202	16,936	252,608	4
	108,640	8,693	40,031	3,935	161,299	22,728	61,289	84,072	168,089	329,388	6
	186	.....	4,078	278	4,542	860	1,956	5,200	8,016	12,558	0
	520,028	41,719	103,993	5,876	671,616	50,666	107,434	156,746	314,846	986,462	17
Buoys: Lighted..... Unlighted..... Total..... Grand total.....	.....	.....	43,194	665	43,859	26,374	26,375	21,523	74,272	118,131	2
	.....	.....	31,848	1,170	33,018	27,368	27,368	3,361	58,097	91,115	1
	.....	.....	75,042	1,835	76,877	53,742	53,743	24,884	132,369	209,246	3
	2,708,226	462,808	1,015,716	46,250	4,233,003	430,111	531,885	692,194	1,654,190	5,887,193	100

^a Includes offices, except expenses of publications.
^b Includes depots and tenders; also item excepted above, charged to supplies.
^c Includes light vessels, light stations, minor fixed aids, and buoys.

SUMMARY OF COSTS, LIGHTHOUSE SERVICE, FISCAL YEAR ENDED JUNE 30, 1917—Con.

AVERAGE COSTS OF SELECTED FEATURES.

Average cost of—	Salaries.	Subsistence.	Illuminants.	Fuel.	Other supplies.	Incidentals.	Total maintenance.	Repairs and improvements.	Total.
District office, exclusive of third.....	\$12,084	.....	.....	.....	\$1,847	\$62	\$13,992	.....	\$13,992
District depot, exclusive of third.....	7,372	.....	.....	.....	2,592	821	10,786	\$3,566	14,352
Large tender, Pacific.....	23,397	\$6,341	.....	\$13,935	3,386	208	47,267	3,629	50,896
Large tender, Atlantic.....	19,591	6,135	.....	9,073	3,781	221	38,800	3,121	41,921
Medium tender.....	13,926	4,278	.....	4,715	2,472	115	25,506	6,348	31,854
Exposed light vessel.....	8,224	1,995	\$96	1,309	838	29	12,492	4,001	16,493
Moderately exposed light vessel.....	4,569	1,290	125	366	414	7	6,772	1,168	7,940
Lake light vessel.....	3,813	1,079	78	340	377	14	5,702	1,408	7,110
First-order light stations with powerful fog signals...	2,511	429	202	463	332	68	4,005	1,128	5,133
First-order light stations without fog signals.....	1,802	319	147	107	180	78	2,633	347	2,980
Fourth-order light stations with powerful fog signal.....	1,484	289	65	307	200	27	2,373	678	3,051
Fourth-order light stations without fog signal.....	686	130	35	47	76	3	977	172	1,149
Lens lantern.....	216	26	15	8	12	2	281	a 47	328
Minor light, river districts.....	84	.....	2	.....	4	.....	90	a 1	91
Minor light, other districts.....	113	.....	11	.....	5	1	130	a 20	150
High-pressure acetylene light.....	38	3	26	3	5	1	76	a 129	205
High-pressure acetylene buoy.....	.....	.....	31	.....	b 45	.....	76	a 44	c 120
Oil-gas buoy.....	.....	.....	32	.....	b 28	1	61	a 19	c 80

a Figures do not include cost of establishment of new aids.

b Figures include transportation charges of all kinds, such as freight on new buoys, etc.

c Figures do not include renewal of appendages.

APPROPRIATIONS AND EXPENDITURES.

The appropriations for the maintenance of the Lighthouse Service for the fiscal year 1918 were \$5,338,680, being \$99,650 in excess of those for the preceding fiscal year. The estimates for maintenance appropriations for 1918 were divided into one appropriation for general expenses of supplies, repairs, etc., and three appropriations for salaries, with an alternative providing for all maintenance appropriations in a single item. This alternative proposition was not authorized by Congress. It is believed, however, that with this form of appropriation a more economical and efficient administration of the Lighthouse Service could be effected, and in the estimates for the next fiscal year attention has been drawn to the fact that if this consolidation is authorized a reduction of \$25,000 in the total estimates may be safely made. The appropriations for special works made for the fiscal year 1918 amounted to \$1,299,300. An appropriation of \$300,000 was also made to the United States Coast Guard for improved telephone coastal-communication systems, including connections to light stations, which will be of benefit to this Service.

The average appropriations for special works for the 10 preceding years, 1908 to 1917, inclusive, amounted to \$817,404.

The detailed estimates for the fiscal year 1919 are given on page 68. The total amount for general maintenance is \$1,458,150 more than the appropriation for the present year. Particular attention again is invited to the urgent need of the Lighthouse Service for additional funds. The cost of all materials has greatly increased, salaries and wages have been uniformly advanced, and in order that the Service

may be maintained at a proper standard of efficiency a corresponding increase in its appropriations is necessary. The Bureau desires to lay special stress on this matter, and under a separate heading includes a more detailed statement with reference to pay on vessels.

The estimate for the Bureau of Lighthouses in Washington is the same as the appropriation for the preceding year. Estimates for 20 special works have been submitted, aggregating \$1,931,000, considering only group 1, of which items amounting to \$317,000 are authorized by law. This is \$651,700 more than the appropriation for special works for the preceding year, and includes a number of important works for which estimates were submitted last year, but which were not included in the appropriations. The estimates include three new lighthouse tenders, one new light vessel, two new lighthouse depots, four items for establishing or improving aids in general localities, three items for a new system of harbor or channel lights and other aids, two items for improvements of light or fog-signal stations, four items for improvement of lighthouse depots, and one item for light-keepers' dwellings.

In selecting and submitting estimates for those special works believed to be most important, there were considered estimates submitted by officers in the various districts and others for new lighthouse and ship construction aggregating about \$5,600,000. Many items not included in the estimates for this year are thought to be meritorious, and the more important of them are included in group 2 of the estimates for special works, submitted for consideration as the resources of the Government permit them to be taken up. Explanation of the necessity for each of the items of special works is included with the estimates.

The tables following give comparisons of appropriations and expenditures for the Lighthouse Service, beginning with the fiscal year 1914 and including the estimates for 1919.

APPROPRIATIONS, LIGHTHOUSE SERVICE, FISCAL YEARS 1914-1918, WITH ESTIMATES FOR 1919.

[The salaries and allowances of officers of the Army on duty with the Lighthouse Service are not included in this table.]

Item.	Appropriations.					Esti- mates, 1919.
	1914	1915	1916	1917	1918	
MAINTENANCE.						
Salaries, Bureau of Lighthouses.....	\$64,510	\$64,030	\$64,030	\$64,030	\$64,030	\$67,030
Salaries of keepers of lighthouses.....	930,000	940,000	940,000	940,000	940,000	1,080,000
General expenses, Lighthouse Service.....	2,750,000	2,775,000	2,775,000	2,790,000	2,850,000	3,608,800
Salaries, lighthouse vessels.....	967,420	997,600	1,010,000	1,070,000	1,104,650	1,650,000
Salaries, Lighthouse Service.....	360,000	375,000	375,000	375,000	380,000	391,000
Total for maintenance.....	5,071,930	5,151,630	5,164,030	5,239,030	5,338,680	6,796,830
Unexpended balances (obligations estimated).....	50,734	53,424	47,171	67,377		
SPECIAL WORKS.						
New light and fog-signal stations.....	432,500	63,000		193,000	155,000	
Light vessels.....	125,000				280,000	160,000
Lighthouse tenders.....			250,000	20,000	210,000	600,000
Keepers' dwellings.....						75,000
Improvement of aids.....	22,600	50,000		736,000	613,300	443,000
Lighthouse depots.....	125,000	23,000		50,000	21,000	653,000
Total for special works.....	722,600	136,000	250,000	999,000	1,279,300	1,931,000
Total maintenance and special works.....	5,794,530	5,287,630	5,414,030	6,238,030	6,617,980	8,727,830

**EXPENDITURES FROM APPROPRIATIONS, LIGHTHOUSE SERVICE, FISCAL YEARS
1913-1917.**

[Actual expenditures, regardless of year of appropriation.]

Expenditures.	1913	1914	1915	1916	1917
For maintenance.....	\$5,037,778	\$5,166,009	\$5,111,121	\$5,002,706.25	\$5,220,473.07
For special works.....	461,627	538,338	500,516	748,833.50	651,298.99
Total.....	5,499,405	5,704,947	5,611,637	5,751,539.75	5,871,772.06

DEPOTS.

The Lighthouse Service maintains 42 depots in the various districts for the storage and distribution of supplies and for other purposes. While these depots are not in themselves aids to navigation, they bear such a direct and important relation to the efficient maintenance of the latter that it is essential to provide them with adequate facilities. A number of items for depots are submitted in the estimates, some of which are repeated from previous annual reports, and three of which are authorized by law, though no appropriation has yet been made. Particular attention is invited to these cases, as follows:

In the second district the present depot at Lovells Island, Boston Harbor, is for a number of reasons unsatisfactory, and Congress has authorized the transfer for this purpose of the old marine-hospital site at Chelsea, Boston. This property was formerly under lease to private parties, but has been acquired by the Lighthouse Service, in an unimproved condition. A dock and storehouse are urgently needed. The act of August 28, 1916, authorized this work at a cost not to exceed \$85,000, but no appropriation of funds was made.

In the eleventh district estimates are submitted for repairs and improvements at the depot at Detroit, Mich. This work was also authorized by the act of August 28, 1916, but funds have not yet been appropriated. The authorized limit of cost is \$53,000.

In the nineteenth district the headquarters of the Lighthouse Service are at Honolulu, and storage facilities are either rented or granted by the courtesy of other branches of the Government. The establishment of a permanent depot in this district would facilitate the work of the Service, and estimates are submitted for that purpose. The act of August 28, 1916, authorized the establishment of a temporary depot on leased land at a cost not to exceed \$5,000 and also authorized the construction of a permanent depot at a limit of \$90,000, but no funds were appropriated for either object.

The act of July 1, 1916, contained an appropriation of \$50,000 for improvements at Woods Hole Lighthouse Depot, Mass. These funds have been used for dredging the channel and basin around the wharf and also for the erection of a brick storehouse, to replace the present timber structure, now nearing completion. The depot is well located for the work of the Service in the vicinity, and on completion of the proposed improvements will be very useful.

The new carpenter shop at the general lighthouse depot, Tompkinsville, N. Y., built under an appropriation of \$23,000 made by the act of August 1, 1914, is now completed and is of benefit in avoiding the fire hazard of the old frame building formerly used for that purpose, as well as providing a modern, well-lighted shop for all kinds of special woodwork used by the Service.

The act of June 12, 1917, appropriated \$21,000 for improvements of the offices and laboratory at the general depot. Plans and specifications for this work are now being prepared.

In the following districts provisions should be made for improved depot facilities:

An estimate is submitted for enlarging the machine shop at the general lighthouse depot at Tompkinsville, N. Y. The present machine shop is so constructed as to be unadaptable for the work it is now called upon to do, and it must be extended to be efficient for the great variety of work at this depot.

An estimate for a dry dock at the general depot is also submitted. The congested conditions prevailing at private shipyards and navy yards make it impossible to attend to the docking of lighthouse vessels at the proper intervals. Such a dock also would be of great value to other maritime services of the Department, and it is believed that considerable economy would thus result to the Government as a whole. An estimate for improvement of the wharves at the general depot is also submitted for the same reasons as stated above.

In the fifth district the present principal depot at Portsmouth, Va., is inadequate both in area and in water front, considering the size of the district and the number of lighthouse vessels to be accommodated. Estimate is submitted for enlarging this depot or establishing a new one.

The new lighthouse depot at Charleston, S. C., for which an appropriation was made by the act of October 22, 1913, has been completed so far as funds permitted and was occupied regularly for the first time on August 1, 1916. The old dock at Castle Pinckney was returned to the War Department January 8, 1917, after occupancy by the Lighthouse Service for nearly 39 years. Further improvements at Charleston Depot are needed, for which an estimate is submitted in group 2, for consideration when resources permit.

In the seventh district at Key West, Fla., the present depot property is on the grounds of the naval station and is surrounded by coal piers. The location is objectionable from the standpoint of caring for lighthouse supplies in a proper manner as well as interfering with the normal growth of the naval station. An estimate for a new depot, to relieve this situation, is submitted also in group 2.

The need for a depot at New Orleans, La., in the eighth district, has long been felt, and much unnecessary storage and lighterage expense has been incurred on this account. An estimate for this purpose also is included in group 2.

The present depot at Milwaukee, Wis., is practically surrounded by coal yards, and the coal dust is objectionable. Consideration is being given to obtaining a more suitable site.

In the sixteenth district, which in 1910 was organized as a separate lighthouse district, no permanent arrangement has yet been made for a depot, but temporary space is being rented at Ketchikan. A project has been submitted for consideration by Congress, as resources permit, for the purchase of a site and the necessary equipment for a lighthouse depot in Alaska.

In the eighteenth district figures are submitted, for consideration as resources permit, for repairs and improvements to the Goat Island Depot, Cal.

LIGHTHOUSE TENDERS.

The tenders of the Service have been employed to good advantage during the year. The 50 vessels which have been in commission have steamed a total of about 464,000 nautical miles in their work of supplying light stations, maintaining the buoyage system, transporting construction materials, and carrying the officers and employees of the Service to their stations or on inspection duty.

Contract was awarded May 4, 1915, for the construction of the first-class seagoing lighthouse tender *Cedar*, for service in Alaska. The vessel was launched December 27, 1916; the official trials were satisfactorily completed June 12 and 13, 1917; the vessel was conditionally accepted June 30, 1917, and proceeded from Long Beach, Cal., to station at Ketchikan, Alaska, on July 11, 1917. Stops were made at San Francisco and Seattle for minor fitments and receiving cargo for lighthouse work and other Government services, and the vessel arrived at Ketchikan August 18, 1917.

A contract was awarded for the shallow-draft tender *Palmetto* on September 27, 1915, for service in the inland waterways of the sixth lighthouse district. The vessel was launched June 30, 1916, and completed March 19, 1917, being immediately assigned to duty in the district.

An appropriation of \$20,000 was made by the act of July 1, 1916, for a light-draft tender and barge for use in establishing and maintaining aids along the intercoastal waterways of Texas and Louisiana. Proposals have been twice advertised for this equipment without results. Therefore it has been necessary to defer action until conditions become more favorable.

With the increase in the number of aids to navigation and the deterioration of older vessels, it will be necessary to construct on an average one or two new tenders each year. The act of June 12, 1917, appropriated \$150,000 to replace the tender *Gardenia*, which has been surveyed and laid up as being of no further use to the Service. The same act appropriated \$60,000 for furnishing seagoing tenders with radio equipment. Work on these objects is now progressing.

Estimates have been submitted for three new lighthouse tenders to replace the present tenders *John Rodgers*, *Jessamine*, and *Holly*, or for general service, as may be found most desirable, at a cost of \$200,000 each. The vessels mentioned are all old, unseaworthy, side-wheel steamers, which should be laid up as soon as arrangement can be made.

The acquisition of the tender *Dandelion*, which went into commission April 7, 1917, for use on the upper Mississippi River, with the publication of soundings, channel reports, and other bulletins of interest to rivermen, has effected a decided improvement and has proven satisfactory to commercial lines operating on the river.

Copies of the Department's pamphlet entitled "Advisory Conference on the Subject of Making Passenger Vessels More Secure from Destruction by Fire" were distributed to the district officers and to each vessel in the Service.

Special instructions were issued relative to inspections of hoisting gear on lighthouse tenders, including all parts thereof, with a view of detecting any defect impairing their safety for handling cargo and

buoys, taking into consideration the increased sizes and weights now used.

A standard plan of draft marks for lighthouse vessels was prepared and issued during the year, with instructions for checking the draft marks already in place, and a standard report form covering the information desired at the periodical dockings of vessels was also distributed to the district officers.

The following tenders have either been extensively overhauled or such work has been started during the fiscal year 1917: *Lilac*, *Madrone*, *Maple*, *Larkspur*, and *Ivy*.

In the repair of vessels particular attention has been given to improvements which increase the comfort of the crew, and alterations with this end in view have been made on several tenders during the fiscal year.

It is probable that during the current year extensive overhaul will be completed or undertaken on the following tenders: *Mayflower*, *Holly*, *Iris*, *Azalea*, *Mangrove*, *Crocus*, *Marigold*, *Amaranth*, *Oleander*, *Pansy*, *Arbutus*, *Sumac*, and *Mistletoe*.

The following was the number of tenders of the Lighthouse Service on June 30 of the years specified, omitting vessels not having regular crews and those less than 50 feet in length: 1910, 51; 1911, 46; 1912, 45; 1913, 44; 1914, 45; 1915, 46; 1916, 47; 1917, 51. On June 30, 1917, the following was the status of the tenders: In actual service, 50; indefinitely laid up, 1; undergoing repairs, 0.

LIGHT VESSELS.

The Lighthouse Service maintains light vessels on 53 stations and has for this purpose 68 light vessels, of which 15 are relief vessels. Some of these vessels are old, 13 having been built over 50 years ago; one is 68 years old. Some of the older vessels are in a condition which does not warrant extensive repairs.

Contracts were awarded for the construction of second-class light vessels *No. 101* and *No. 102* on March 6, 1915. *No. 102* was launched November 27, 1915, accepted January 3, 1917, and was placed on station at Southwest Pass, entrance to Mississippi River, La., February 24, 1917. *No. 101* was launched January 12, 1916, accepted September 27, 1916, and was placed on station off Cape Charles, Va., October 4, 1916.

Plans and specifications have been completed and bids invited for construction of the new third-class light vessel *No. 99*, and a contract for construction was awarded June 29, 1916. Favorable progress was made by the builders up to July 10, 1917, when a fire of unknown origin destroyed the building ways and adjacent buildings at the shipyard, damaging the vessel beyond repair. The matter of rebuilding was at once taken up with the contractors, but the approximate time of completion can not be determined at present.

The balance of the appropriation remaining for light vessel *No. 100* is insufficient for the construction of the vessel, due to the high cost of materials, and consideration of the matter, therefore, has been deferred for the present.

The act of June 12, 1917, appropriated \$130,000 for a light vessel off Cape Charles or for general service and \$150,000 for light vessels on the Great Lakes, where they are much needed to replace old vessels

that should be withdrawn from duty. Work on the plans for these vessels was progressing at the close of the year.

An estimate is submitted for a new light vessel for the Gulf coast or for general service, which is greatly needed.

The work of reconstructing light vessel No. 82, referred to in previous annual reports, was completed in time for the vessel to go on station as a relief vessel for the Great Lakes during the fall of 1916, and has since been engaged in that work.

Careful attention has been paid in designing and remodeling light vessels to making all parts of such vessels accessible for cleaning and painting and to improvements for the comfort of the crew.

The following light vessels have either been extensively overhauled or such work has been started during the last fiscal year: No. 39, No. 49, No. 52, No. 56, No. 60, No. 66, No. 67, No. 69, No. 70, No. 71, No. 84, and No. 88.

It is probable that during the current fiscal year extensive overhaul will be completed or undertaken on the following light vessels: No. 2, No. 4, No. 11, No. 16, No. 41, No. 42, No. 43, No. 51, No. 55, No. 68, No. 72, No. 80, and No. 97.

The following was the total number of light vessels and stations on June 30 of the years named:

Year.	Light vessels.	Light- vessel stations.	Year.	Light vessels.	Light- vessel stations.
1910.....	68	54	1914.....	66	52
1911.....	63	51	1915.....	66	53
1912.....	65	51	1916.....	66	53
1913.....	67	53	1917.....	68	53

Of the present light vessels 38 have self-propelling machinery and 28 are provided only with sail power. Two have no means of propulsion.

On June 30, 1917, the following was the status of the light vessels: Regular vessels on station, 49; relief vessels on station, 4; relief vessels at depots, 7; regular vessels under repair, 4; relief vessels under repair, 4; relief vessels laid up, 0.

SALARIES AND WAGES ON LIGHTHOUSE VESSELS.

The greatest difficulty encountered in the efficient maintenance of the Service during the past two years has been the question of pay on lighthouse tenders and light vessels. As is well known, abnormal shipping conditions have been created by the European war, and former standard rates of pay on vessels have been completely discarded. For example, the present monthly pay of seamen in the Atlantic coast merchant marine (coastwise service) is exactly double the former standard wages, and proportional increases have been made in all other grades, including officers as well as crews. It is, therefore, quite apparent that the Lighthouse Service can not cope with such conditions by appropriations based on abandoned and inadequate pay scales.

The following table gives figures relating to the number of changes made in crews of lighthouse vessels during the fiscal year 1917:

Position.	Number authorized.	Number actually employed.	Ratio per position.	Position.	Number authorized.	Number actually employed.	Ratio per position.
Quartermasters.....	104	328	3.2	Stewards.....	35	59	1.7
Machinists.....	93	260	2.8	Cooks.....	114	325	2.8
Seamen.....	576	2,334	4.1	Mess attendants.....	82	405	4.9
Firemen, first class.....	187	789	4.2	Total.....	1,275	4,999	3.9
Firemen, second class.....	84	498	5.9				

The changes in senior officers have not been many, but those in junior positions, such as second officers and second assistant engineers of lighthouse tenders and mates and assistant engineers of light vessels, have been discouragingly numerous. For example, 81 persons filled 33 positions of junior deck officers, and 76 persons filled 33 positions of junior engineer officers, with corresponding ratios of men per position during the single fiscal year 1917 of 2.5 and 2.3, respectively.

This condition is of serious importance to the future well-being of the Service, as in the ordinary course of events these men would eventually be promoted to more responsible places, after the necessary experience in the manifold duties of the Service had been acquired.

Many deplorable situations have arisen in the past few years on account of insufficient pay—vessels have been tied up with urgent work remaining undone, or have gone to sea undermanned or partially manned by incompetent and unfit persons at serious risk to both life and property. Indeed, were it not for the commendable loyalty and fidelity to the Service displayed by the senior officers of these vessels, who have almost uniformly remained at their posts despite these discouraging circumstances, it is doubtful if the work accomplished could have been performed without some disaster to vessels of this Service or to merchant vessels by reason of lighthouse work being omitted or improperly executed. As it is, the annual relief of buoys, a most important obligation of the Service, strictly required by its regulations, has been falling behind, and this condition will speedily become acute and dangerous if not remedied at an early date. For example, in the calendar year 1915 it was not possible to relieve 148 buoys; in 1916 the corresponding figure was 336; and in 1917 the number will probably be much larger.

The inconvenience in operating with insufficient crews and constantly changing personnel to whom the duties were new has been very considerable and embarrassing to the Service, causing a serious handicap to efficient work, due to constantly breaking in green men of the low grade obtainable for the wages paid. By various make-shifts the vessels have been kept in commission except for relatively short periods and have performed such work as possible with the number and character of men obtainable. It is estimated that the loss of time due to delay in obtaining men and doing the work with short crews has caused a decrease in efficiency as to amount of work done of at least 20 per cent during the past year, not taking into

consideration the loss due to the inferior condition in which vessels are maintained or the hazard of attempting to proceed with dangerous duties with a short-handed and inefficient force. As the total annual operating expense of lighthouse vessels is about \$1,750,000, the direct financial loss may be set at about \$350,000 during the fiscal year 1917. A most disturbing aspect as to the future is disclosed by recent inspections of vessels, which clearly indicate that a general deterioration in upkeep has been suffered during the past two years from this cause. There is no doubt that the employment of incompetent crews has caused a large loss to the Government, due wholly to the lower wages paid on lighthouse vessels as compared with the merchant marine.

The Department has been fully aware of these conditions, which are by no means confined to this Service, and which have been encountered with equal force by other maritime services of the Government, and the Secretary has given the matter his close personal attention, by the appointment of a departmental marine board to consider such problems and in urging the necessity for greater appropriations. The 5 and 10 per cent increase authorized by Congress has, of course, been of benefit, but is quite insufficient to establish pay scales that will obtain the proper class of seafaring men.

In developing the detailed estimates submitted, the figures have been based on an agreement that was the result of negotiations between the Department of Labor, the Department of Commerce, the Shipping Board, and representatives of both employees and employers, which fixed a wage scale to remain in force until a year after the war ends. The details of this agreement were published in the Official Bulletin issued by the Committee on Public Information on August 11, 1917, and have been applied to the Lighthouse Service by the authority of the Secretary of Commerce. It is, therefore, earnestly recommended that the estimate as submitted be enacted into law, in order that the work of the Service may be properly carried out.

COOPERATION.

In accordance with the established custom of the Service, every effort has been continued to consult the needs of maritime interests and to cooperate effectively with other branches of the Government in matters relating to the work of the Lighthouse Service.

During the past year the most important work of this character has been the cooperation of the Lighthouse Service with the military branches of the Government on account of war conditions. The naval appropriation act of August 29, 1916, authorized the President, whenever in his judgment a sufficient national emergency exists, to transfer to the service and jurisdiction of the Navy Department or of the War Department such vessels, equipment, stations, and personnel of the Lighthouse Service as he may deem to the best interest of the country, and also provided that the Secretary of the Navy, the Secretary of War, and the Secretary of Commerce shall jointly prescribe regulations governing this condition. These regulations were issued April 11, 1917, and on the same date the President signed an Executive order transferring 30 lighthouse tenders to the War Department and 15 lighthouse tenders, 4 light vessels, and 21 light stations to the Navy Department. By July 1, 1917, all tenders

transferred to the War Department had been turned over to the Navy, which condition still obtains at the time of this report.

The Bureau has continued to cooperate with the Steamboat-Inspection Service in detailing employees for the purpose of making stability tests of a number of merchant vessels under examination by that Service, and has also designated, by authority of the Secretary of Commerce, deck officers of lighthouse tenders to assist in the examination under the Steamboat-Inspection Service of applicants for certificates as lifeboat men required by the recent seaman's act.

Cooperation was also rendered to the Bureau of Fisheries in inspections and supervision of repairs to vessels belonging to that service under direction of its representatives; and arrangements were also made, at the request of the Bureau of Fisheries, for catching sharks from light vessels on the South Atlantic and Gulf coasts, the skins to be used in experimental tanning work conducted by that bureau.

Arrangements were also made with the Weather Bureau, Department of Agriculture, to furnish that service certain meteorological observations made on selected light vessels and light stations. In the case of light vessels equipped with radio, these observing stations are particularly valuable, not only in obtaining forecast data for use of the Weather Bureau but also in distributing such forecasts to incoming and outgoing merchant ships.

The Forest Service, Department of Agriculture, continued to render valuable assistance to the Lighthouse Service in the matter of examinations and reports relating to timber on various lighthouse reservations, under authority of the act of March 3, 1915.

Measures were taken to furnish the Coast and Geodetic Survey with copies of monthly records showing the hours of operation of various important fog-signal stations. Further assistance was rendered the survey by the placing of special buoys for use in offshore surveying operations and by the detail of a technical employee on the trial board of a new steamer for that service.

The Navy Department, by letter of January 25, 1917, authorized the commandants of a number of navy yards and stations to issue, upon request of commanding officers of vessels of the Lighthouse Service, such articles of provisions as might be spared without detriment to the naval service, payment to be made by transfer of funds to the proper appropriations.

Arrangements were made with the office of the Chief of Engineers, War Department, relative to the display of lights and signals by persons or corporations obtaining permits from that department for building structures or work in navigable waters, and also on the subject of charges made by the Lighthouse Service for expenses incurred in the marking of wrecks or other menaces to navigation.

The Public Health Service rendered valuable assistance in the matter of sanitary advice, inspections, and fumigations at various stations and vessels of the Lighthouse Service, and also in the preparation of regulations governing the physical examination of keepers provided for in the act of August 28, 1916, which authorized free medical relief to that class of employees.

The Bureau of Mines continued to assist the Lighthouse Service in making analyses of coal, and detailed information was furnished that bureau, at its request, in reference to coal purchased by the Lighthouse Service on contracts providing for analysis.

SAVING OF LIFE AND PROPERTY.

During the fiscal year 1917 services in saving of life and property were rendered and acts of heroism performed by employees of the Lighthouse Service on vessels or at stations on 160 occasions, a list of which is given on page 54.

In each of these cases a commendatory letter was issued by the Secretary, and in the case of the work of the lighthouse tender *Cypress*, Capt. John P. Johnson commanding, during the hurricane in the vicinity of Charleston, S. C., July 13-15, 1916, a letter of commendation was also issued by the Navy Department. During this storm the services performed by the *Cypress* included the rescue of 97 marooned persons from a low island, the placing of two disabled lighthouse vessels in a safe anchorage, and the rescue of the master and 21 men from the wrecked naval collier *Hector*, off Cape Romain, under most difficult circumstances.

REPORT OF OPEN-MARKET PURCHASES.

In compliance with the act of June 17, 1910, there is submitted separately as a part of this report a list of purchases of materials and supplies for the Lighthouse Service made without obtaining bids under public advertisement, with the reasons for so purchasing.

LEGISLATION ENACTED AFFECTING THE LIGHTHOUSE SERVICE.

The following is a summary of special legislation affecting the Lighthouse Service enacted at the first and second sessions of the Sixty-fourth Congress and the first session of the Sixty-fifth Congress during the fiscal year 1917.

The deficiency act approved September 8, 1916, appropriated \$125,000 for repairing hurricane damage on the Gulf coast caused by the storm of July 5-6, 1916.

The deficiency act approved April 17, 1917, appropriated \$56.88 for adjudicated claims for damages for which vessels of the Lighthouse Service were found responsible.

The sundry civil act approved June 12, 1917, made the following appropriations: Lighthouse tender, third district or general service, \$150,000; Cape Charles, Va., light vessel, \$130,000; light vessels for the Great Lakes, \$150,000; aids to navigation, Pearl Harbor, Hawaii, \$80,000; improving office and laboratory at the general depot, Tompkinsville, N. Y., \$21,000; aids to navigation, Huron Harbor, Ohio, \$4,500; light station, Point Borinquen, P. R., \$85,000; rebuilding Chicago Harbor Light Station, Ill., \$88,000; aids to navigation, Fairport, Ohio, \$42,000; light and fog signal, Sand Hills, Lake Superior, Mich., \$70,000; improving light and fog signal, Manitowoc North Breakwater, Wis., \$21,000; improving aids, East River, N. Y., \$16,000; aid to navigation, Keweenaw waterway, Portage River, Mich., \$105,000; improving aids, Cape Charles City, Va., \$12,800; improving aids, eastern shore Chesapeake Bay, Md. and Va., \$29,000; aids to navigation, Alaska, \$60,000; aids to navigation, Indiana Harbor, Ind., \$100,000; improvements, Great Salt Pond Light Station, R. I., \$20,000; radio equipment, lighthouse tenders, \$60,000; and aids to navigation, Washington and Oregon, \$35,000. These objects were authorized by the acts of March 3, 1915, and August 28, 1916, which did not appropriate funds.

The sundry civil act of June 12, 1917, also contained an appropriation of \$300,000 to enable the United States Coast Guard to develop its present telephone system of coastal communication, including connections to important light stations which at present have no rapid means of communication.

The act of August 28, 1916, granted authority for the following purposes:

Exchange of rights of way of the United States in connection with lands pertaining to the Lighthouse Service for such other rights of way as may be advantageous to the Service, providing also for the payment of any expenses, not exceeding \$500, incurred by the United States in making such exchange, from the appropriation "General expenses, Lighthouse Service."

The establishment and maintenance, in the discretion of the Commissioner of Lighthouses, of post-lantern lights and other aids to navigation on the Mobile, Tombigbee, Warrior, and Black Warrior Rivers, Ala., and Lake Tahoe, Cal. and Nev.

The purchase, necessary equipment, repair, and operation of one motorcycle for the use of the Lighthouse Service in the Hawaiian Islands.

Medical relief for light keepers and assistant light keepers without charge at hospitals and stations of the Public Health Service, and providing also for certain physical examinations of persons who enter the Service hereafter.

The following works were authorized by the same act, at the limits of cost specified, but no appropriation of funds was made: Light-keepers' dwellings, \$75,000; lighthouse depot for second district, \$85,000; improvements at Detroit Depot, Mich., \$53,000; temporary depot at Honolulu, Hawaii, \$5,000; and lighthouse depot for nineteenth district, \$90,000. A number of other projects authorized in this act were appropriated for in the act of June 12, 1917, as mentioned in the list on page 63.

The naval appropriation act of August 29, 1916, authorized the transfer of portions of the Lighthouse Service to the War and Navy Departments under conditions as previously explained on page 22, and provided that the expenses of such transferred portions should be defrayed out of the appropriations of the department to which the transfer was made. This provision was subsequently amended by the naval deficiency act of June 15, 1917, which provided that the naval appropriations shall be available for expenses of the Lighthouse Service while cooperating with the Navy in so far as the regular appropriations for the Lighthouse Service are insufficient.

The employees' compensation act of September 7, 1916, provides, among other matters concerning payments to employees of the United States suffering injuries while in the performance of their duties, that such payments shall be made from the employees' compensation fund, instead of from salary appropriations of the Lighthouse Service as heretofore.

The act of February 14, 1917, referred the case of the British steamship *Esparta*, which on October 26, 1905, was in collision with the lighthouse tender *Magnolia* in the Mississippi River below New Orleans, to the United States district court for the eastern district of Louisiana, with jurisdiction and authority to determine the liability of the United States.

The act of March 2, 1917, providing a civil government for Porto Rico, stipulated in section 6 thereof that the status of lighthouse work shall remain under Federal control as at present.

The legislative act of March 3, 1917, and the sundry civil act of June 12, 1917, provided for the Bureau and the field force of the Lighthouse Service, respectively, identical legislation for increased compensation during the fiscal year 1918 at the rate of 10 per cent per annum to employees receiving less than at the rate of \$1,200 per annum and at the rate of 5 per cent per annum to employees receiving not more than at a rate of \$1,800 per annum and not less than \$1,200 per annum.

The act of June 12, 1917, also provided that the limit of cost of construction of outbuildings at any one light station in any one fiscal year may be increased from \$200 to \$500, as recommended by the Department.

SPECIAL LEGISLATION NEEDED.

The following additional legislation for the Lighthouse Service is considered desirable:

The salaries of lighthouse inspectors are, by the act of June 17, 1910, limited to \$2,400 a year, except the inspector of the third district, whose salary is fixed at \$3,600. The salary of \$2,400 is inadequate because of the heavy responsibilities with which the inspector is charged and the technical and business ability required to successfully discharge the duties. The compensation of these positions should be sufficient to bring into and retain in the Lighthouse Service a class of persons fully competent to efficiently conduct such important work. The inspectors should be men of high character and qualifications, including technical knowledge as to engineering and nautical affairs, and should have business ability. It is recommended that the salary of inspectors be increased to not to exceed \$3,600 a year.

The salaries of lighthouse inspectors are materially less than those of various other officers of the Government whose requirements and responsibilities are not considered to be any greater. The Secretary of Commerce, at pages 145 and 146 of his annual report for the fiscal year 1915, described this situation fully, and attention is invited to his remarks on the subject. A provision for increasing the limit of salary of lighthouse inspectors was favorably considered by committees of both Houses of Congress, and was included in House bill 14338 as reported by the Committee on Interstate and Foreign Commerce April 15, 1916, and in Senate bill 21 as reported by the Committee on Commerce May 29, 1916, and as passed by the Senate July 27, 1916, all in the Sixty-fourth Congress, first session. The same provision is also included in House bill 2298 and in Senate bill 993 (65th Cong., 1st sess.). Reference is further made to the hearings on this subject on January 18, 1917, before the Senate Committee on Commerce. House bill 2298 was favorably reported by the Committee on Interstate and Foreign Commerce on September 21, 1917, but no action was taken owing to adjournment on October 6, 1917.

It is also recommended that a designation be given to the officers in charge of lighthouse districts which will more adequately indicate their duties than the present title of lighthouse inspector.

It is recommended that authority be granted to make the appropriation "General expenses, Lighthouse Service" available for the payment of traveling expenses and subsistence of teachers employed by States or private persons to instruct the children of keepers of lighthouses. The Bureau has endeavored to develop plans for the proper education of keepers' children at stations not accessible to schools, and in some States has been able to obtain the cooperation of the State educational authorities. It is believed that Government assistance in the matter of providing subsistence for such teachers while at stations would assist in promoting a worthy object at comparatively trifling expense.

It is recommended that the rate of commutation of rations to keepers and assistant keepers of the Lighthouse Service, fixed by the act of May 14, 1908, at 30 cents per day, be increased to 45 cents per day. Such an increase was authorized the United States Coast Guard by the act of June 12, 1917, and the extraordinary advance in the cost of foodstuffs, it is believed, makes a similar action in the Lighthouse Service fully justified.

The act of March 2, 1867, fixed the salaries of lighthouse keepers at not to exceed an average of \$600 per annum to each keeper. This rate has remained unchanged for over 50 years, and under present conditions it is practically impossible to attract and retain competent persons for this class of work at a salary so low. It is recommended, therefore, that the average pay be increased to \$700 per annum.

The Bureau, acting in cooperation with the Division of Publications of the Department and the Superintendent of Documents, Government Printing Office, has been endeavoring to devise some means whereby a nominal price may be placed on lighthouse publications, thus avoiding the present free and somewhat wasteful system of distribution. In arranging the details of this matter, business difficulties have arisen with private booksellers and agencies outside of the Government service, who decline to make the necessary returns of cash, stocks on hand, etc., unless a commission is allowed them on sales, following the usual commercial practice in this respect. Appropriate recommendations for legislation to overcome this difficulty, therefore, are submitted, providing for the sale of such publications with the allowance of commissions under proper regulations.

Recommendation is made that authority be granted to establish and maintain post-lantern lights and other aids to navigation, out of the annual appropriations for the Lighthouse Service, on Lakes Union and Washington, in the State of Washington. The lighting of inland waters is limited to those specifically authorized by Congress, and such authority has not been granted for the lakes specified. The Lake Washington Ship Canal, opened July 4, 1917, permits deep-sea shipping to enter these lakes, and in response to requests that lights be provided the foregoing recommendation is submitted.

It is also recommended that the appropriation "General expenses, Lighthouse Service" be made available for rebuilding light stations and depots and buildings connected therewith. Under present authority of law, if such a structure is completely destroyed by storm or other accident, its rebuilding can not be undertaken without the special authority of Congress, regardless of the extreme urgency of the case, and it is considered to be in the interest of effectively

maintaining the Lighthouse Service that provision for this purpose be made in the appropriation as recommended.

There is great need for provision by law for the retirement of employees of the Lighthouse Service who after long service have lost their ability for active duty by reason of age or disability incident to their work. This is essential to full efficiency in the administration of the Service. In the report for 1912 a statement was given showing the practice in a number of important foreign countries with reference to the pensioning of employees in the respective lighthouse services in common with other civil employees in those countries, from which it appears that a retirement system is in force with favorable results under all of the other governments mentioned. On April 24, 1916, the Senate unanimously passed a bill providing for the optional retirement of officers and employees of the Bureau of Lighthouses and the Lighthouse Service at the age of 65 years after 30 years' service, and compulsory retirement at the age of 70 years. The retirement pay would be at the rate of one-fortieth of the last annual pay for each year of active service, not to exceed thirty-fortieths. The bill was not acted upon by the House of Representatives and has been resubmitted in a modified form covering only field employees.

This action marked the first legislative step toward a system of retirement for the Lighthouse Service which has been earnestly recommended in previous annual reports every year since 1910. The bill had the warm indorsement of the Secretary of Commerce and of the Senate Committee on Commerce, and it is hoped that Congress may see fit to enact some remedial measure of this character into law at an early date.

The statistics as to the various classes of aids to navigation and fuller details on many of the subjects mentioned in this report will be found in the pages following.

Respectfully,

GEORGE R. PUTNAM,
Commissioner of Lighthouses.

To Hon. WILLIAM C. REDFIELD,
Secretary of Commerce.

STATISTICS AND ESTIMATES.

LIST OF OFFICERS OF THE BUREAU OF LIGHTHOUSES AND THE LIGHTHOUSE DISTRICTS.

OFFICERS OF THE BUREAU OF LIGHTHOUSES ON JUNE 30, 1917.

George R. Putnam.....Commissioner of Lighthouses.
John S. Conway.....Deputy Commissioner.
H. B. Bowerman.....Chief Constructing Engineer.
Edward C. Gillette.....Superintendent of Naval Construction.

Principal Assistant Engineer, Rudolph Zirpel.
Inspector for general duty, E. M. Trott.
Chief Clerk, Thaddeus S. Clark.
Examiner, Thomas Flood.

INSPECTORS IN CHARGE OF LIGHTHOUSE DISTRICTS JULY 1, 1916, TO JUNE 30, 1917.

District.	Name.	From—	To—
1st.....	C. E. Sherman.....	July 17, 1911	
2d.....	R. H. Goddard.....	June 27, 1912	
3d.....	J. T. Yates.....	June 20, 1912	
4th.....	T. J. Rout.....	Mar. 1, 1912	
5th.....	H. D. King.....	Jan. 28, 1915	
6th.....	H. L. Beck.....	Jan. 28, 1915	
7th.....	W. W. Demeritt.....	Aug. 22, 1913	
8th.....	B. B. Dorry.....	June 6, 1912	
9th.....	C. A. Lamy.....	Aug. 7, 1912	
10th.....	Roscoe House.....	June 4, 1912	
11th.....	E. L. Woodruff.....	Aug. 19, 1912	
12th.....	L. M. Stoddard.....	Aug. 16, 1912	
13th.....	Lt. Col. G. M. Hoffman, Corps of Engineers, U. S. Army.	Oct. 16, 1913	May 29, 1917
	Maj. Gen. A. Mackenzie, U. S. Army, retired.....	May 29, 1917	
14th.....	Col. Lansing H. Beach, Corps of Engineers, U. S. Army.....	Aug. 10, 1915	
15th.....	Maj. Wildurr Willing, Corps of Engineers, U. S. Army.....	July 1, 1915	June 6, 1917
	Lt. Col. C. S. Smith, Corps of Engineers, U. S. Army.....	June 25, 1917	
16th.....	W. C. Dibreil.....	Aug. 22, 1913	
17th.....	Robert Warrack.....	Feb. 1, 1915	
18th.....	H. W. Rhodes.....	July 6, 1912	
19th.....	A. E. Arledge.....	Sept. 3, 1912	

JURISDICTION OF LIGHTHOUSE SERVICE.

The United States Lighthouse Service is charged with the establishment and maintenance of aids to navigation and with all equipment and work incident thereto on the sea and lake coasts of the United States, on the rivers of the United States so far as specifically authorized by law, and on the coasts of all other territory under the jurisdiction of the United States, with the exception of the Philippine Islands and Panama. The total length of coast line and rivers under the United States Lighthouse Service, measured by steps of 3 miles, is approximately 47,200 miles.

LIMITS OF LIGHTHOUSE DISTRICTS.

First district.—Waters of Maine and New Hampshire.

Second district.—Waters of Massachusetts.

Third district.—Waters of Rhode Island, Connecticut, New York, and New Jersey northward of Cape May.

Fourth district.—Waters of Delaware seacoast and Delaware Bay and River.

Fifth district.—Waters of Maryland, Virginia, and North Carolina to New River Inlet, N. C.

Sixth district.—From New River Inlet, N. C., to Hillsboro Inlet, Fla.

Seventh district.—Waters of Florida from Hillsboro Inlet to Cedar Keys.

Eighth district.—Waters of Gulf coast from Cedar Keys, Fla., to mouth of Rio Grande River, Tex., and Mississippi River below New Orleans.

Ninth district.—Waters of Porto Rico and adjacent United States islands.

Tenth district.—United States waters of St. Lawrence River and Lakes Ontario and Erie.

Eleventh district.—United States waters of Lakes St. Clair, Huron, and Superior, and Detroit River.

Twelfth district.—Waters of Lake Michigan and Green Bay.

Thirteenth district.—Mississippi River above the mouth of the Missouri River, Minnesota, Illinois, Osage, Gasconade, and Missouri Rivers.

Fourteenth district.—Ohio, Tennessee, Kanawha, and Monongahela Rivers.

Fifteenth district.—Mississippi River below the Missouri River to New Orleans, La., and Red River.

Sixteenth district.—Waters of Alaska.

Seventeenth district.—Waters of Washington and Oregon.

Eighteenth district.—Waters of California.

Nineteenth district.—Waters of Hawaiian, Midway, Guam, and American Samoan Islands.

LOCATION OF DISTRICT OFFICES OF THE UNITED STATES LIGHTHOUSE SERVICE, WITH ADDRESS OF THE LIGHTHOUSE INSPECTOR.

District.	Address.	District.	Address.
1st.....	Portland, Me., Y. M. C. A. Building.	11th.....	Detroit, Mich., Post Office Building.
2d.....	Boston, Mass., Customhouse.	12th.....	Milwaukee, Wis., Federal Building.
3d.....	Tompkinsville, N. Y.	13th.....	Rock Island, Ill., Federal Building.
4th.....	Philadelphia, Pa., Post Office Building.	14th.....	Cincinnati, Ohio, Customhouse.
5th.....	Baltimore, Md., New Customhouse.	15th.....	St. Louis, Mo., Customhouse.
6th.....	Charleston, S. C., Old Post Office Building.	16th.....	Ketchikan, Alaska.
7th.....	Key West, Fla.	17th.....	Portland, Oreg., Customhouse.
8th.....	New Orleans, La., Customhouse.	18th.....	San Francisco, Cal., Customhouse.
9th.....	San Juan, P. R.	19th.....	Honolulu, Hawaii, McCandless Building.
10th.....	Buffalo, N. Y., Federal Building.		

LIGHTHOUSE DEPOTS MAINTAINED ON JUNE 30, 1917.

[The principal depot of the district is indicated by the larger type.]

District.	Location.	District.	Location.
1st.....	Bear Island, Me.	8th.....	Mobile, Ala.
	LITTLE DIAMOND ISLAND, ME.		PORT EADS, LA.
2d.....	LOVELLS ISLAND, BOSTON, MASS.	9th.....	Culebrita Island, P. R.
	Woods Hole, Mass.		Guantanamo Bay, Cuba.
3d.....	Goat Island, R. I.		SAN JUAN, P. R.
	Juniper Island, Vt.	10th.....	BUFFALO, N. Y.
	New London, Conn.		Erie, Pa.
	TOMPKINSVILLE, STATEN ISLAND, N. Y.		Maumee Bay, Ohio.
4th.....	Tucker Beach, N. J.		Rock Island, N. Y.
	EDGEWOOD, DEL.		Sandusky Bay (Cedar Point), Ohio.
5th.....	Lewes, Del.	11th.....	DETROIT, MICH.
	Annapolis, Md.		Minnesota Point, Minn.
	Lazaretto Point, Md.		St. Marys River, Mich.
	Point Lookout, Md.	12th.....	Charlevoix, Mich.
	PORTSMOUTH, VA.		MILWAUKEE, WIS.
	Washington Wharf, D. C.		St. Joseph, Mich.
6th.....	Washington, N. C.	16th.....	KETCHIKAN, ALASKA.
7th.....	CHARLESTON, S. C.	17th.....	Ediz Hook, Wash.
	Egmont Key, Fla.		TONGUE POINT, OREG.
8th.....	KEY WEST, FLA.	18th.....	GOAT ISLAND, CAL.
	Fort San Jacinto, Galveston, Tex.	19th.....	HONOLULU, HAWAII.

EXPLANATION OF TABLE ON PAGE 31.

The table of aids to navigation includes all those maintained by the Lighthouse Service, a total of 15,223. On page 38 are given facts regarding the private aids to navigation, 792 in number, maintained under authority. In the statistics relief light vessels are not counted and duplicate or auxiliary lights and fog signals are not counted, but double lights are counted separately when maintained on distinct structures or for distinct purposes. Buoys for the purpose of marking the positions of light vessels or larger buoys are not counted. Fog signals at light stations or on vessels are counted as separate aids, but not those attached to buoys, except in the case of submarine bells, which are counted as separate signals, whether on vessels or on buoys. Otherwise each buoy is counted only once, and if it is included in a higher class it is not in the lower class. Light-vessel lights are not counted separately.

[See note on p. 30.

Class.	1st dist.	2d dist.	3d dist.	4th dist.	5th dist.	6th dist.	7th dist.	8th dist.	9th dist.	10th dist.	11th dist.	12th dist.	13th dist.	14th dist.	15th dist.	16th dist.	17th dist.	18th dist.	19th dist.	Total.
LIGHTED AIDS.																				
Hyper-radiant lights.....	2	5	5	2	8	8	6	3	1	4	3	2	2	2	2	2	9	9	1	1
First-order lights.....	7	3	2	3	2	2	1	2	5	4	10	9	9	5	5	5	2	1	2	57
Second-order lights.....	6	1	3	3	3	3	4	7	2	3	6	6	2	2	2	2	2	4	1	26
Third-order lights.....	1	2	1	1	1	1	1	3	2	3	3	2	2	2	2	2	2	2	1	67
Three-and-one-half-order lights.....	35	25	58	10	49	1	4	12	3	21	46	37	37	4	4	4	18	20	8	23
Fourth-order lights.....	18	15	18	6	22	3	1	13	2	9	16	12	12	2	2	2	2	2	1	352
Fifth-order lights.....	1	5	21	2	8	1	1	1	4	10	4	16	16	2	2	2	2	2	1	138
Sixth-order lights.....	2	7	9	13	4	9	12	7	6	6	27	4	4	2	2	2	2	2	2	72
Range-lens lights.....	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	46
Reflector lights.....	12	22	58	15	45	64	39	161	14	37	90	46	455	570	687	89	23	37	41	121
Lens-lantern lights.....	2	18	169	35	206	173	52	100	2	2	82	7	7	7	7	1	6	20	2	793
Minor lights.....	1	1	10	14	8	4	5	27	6	31	78	17	6	6	6	5	11	8	5	2,970
Electric lights without lens.....	6	45	51	14	52	6	5	27	6	31	78	17	6	6	6	5	11	8	5	53
Light-vessel stations.....	7	5	11	5	10	8	5	9	1	2	12	19	79	39	39	1	5	8	1	367
Gas-lighted buoys.....	1	8	18	5	18	6	6	1	1	10	3	5	5	7	7	1	5	4	1	72
Gas and whistling buoys.....	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	46
Gas and aerial bell buoys.....	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	121
Fleet lights.....	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	793
Total.....	100	172	436	119	530	321	135	347	41	140	386	183	534	609	687	159	340	117	64	5,420
UNLIGHTED AIDS.																				
Light on fixed aids.....	86	103	346	100	442	297	119	308	23	96	287	135	455	570	687	145	316	95	58	4,678
Light on floating aids.....	14	69	90	19	88	24	16	40	1	44	99	48	79	39	39	14	24	22	6	742
Total lighted aids.....	100	172	436	119	530	321	135	347	41	140	386	183	534	609	687	159	340	117	64	5,420
Fog signals, engine power.....	19	21	37	5	15	4	1	3	3	10	38	47	47	47	47	10	23	28	2	200
Fog signals, clock power.....	37	14	59	6	66	3	1	14	1	5	5	9	9	9	9	1	4	8	2	232
Fog signals, hand power.....	12	5	2	1	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	16
Fog signals, electric.....	2	8	9	1	8	5	1	3	1	1	7	4	4	4	4	1	3	4	2	29
Sound time signals.....	19	11	8	1	2	6	3	5	1	1	5	4	4	4	4	1	4	2	2	51
Buoys, whistling (unlighted).....	53	37	57	5	26	7	6	15	4	1	1	3	3	3	3	3	7	15	1	81
Buoys, bell (unlighted).....	117	67	153	111	271	209	215	109	119	15	26	27	27	27	27	149	132	53	60	241
Buoys, iron.....	704	580	865	97	930	6	178	178	5	106	478	117	503	58	58	37	135	29	8	2,013
Buoys, spar wood.....	177	86	50	2	187	517	178	246	5	106	478	117	503	58	58	37	135	29	8	4,833
Daymarks, beacons, etc.....	1,170	829	1,244	227	1,509	847	398	633	120	198	564	209	858	58	58	257	368	184	121	9,803
Total unlighted aids.....	1,270	1,001	1,680	346	2,039	1,168	533	980	170	338	950	392	1,392	607	687	416	708	301	185	15,223
Grand total.....	1,270	1,001	1,680	346	2,039	1,168	533	980	170	338	950	392	1,392	607	687	416	708	301	185	15,223

DETAILS AS TO LIGHTS ON LIGHT VESSELS.

	1st dist.	2d dist.	3d dist.	5th dist.	6th dist.	8th dist.	10th dist.	11th dist.	12th dist.	17th dist.	18th dist.	Total.
Characteristics as to lights:												
1 fixed white light.....		3	1		1			4	4			13
2 fixed white lights.....		2	3	1		1				2	1	10
1 fixed red light.....									1			1
2 fixed red lights.....		2										2
1 fixed white and 1 fixed red light.....		1		3	1					1		6
1 white flashing, or occulting, and 1 fixed red light.....			2									2
1 white light, flashing or occulting.....	1	2	3	3	1	1	1	1	1		1	15
1 red light, flashing or occulting.....		1										1
2 white lights, flashing or occulting.....			1	1	1							3
Illuminants:												
Incandescent oil vapor.....		1			1	1						3
Acetylene.....	1	2	1	3	2							9
Oil (wick).....		7	4	3	1	1		4	5	3	1	29
Oil (wick) and acetylene.....			1									1
Oil (wick) and oil gas with mantle.....			1									1
Oil gas with mantle.....				1								1
Electric arc.....			1									1
Electric incandescent.....		1	2	1			1	1	1		1	8
Illuminating apparatus:												
Fourth order.....		1			1	1			1			4
Fifth order.....				1								1
Reflector.....		2	3	2	1		1	2		1		12
Reflector and lens lantern.....			2									2
Lens lantern.....	1	8	5	5	2	1		3	5	2	2	34

DETAILS AS TO FOG SIGNALS.

Kind and how operated.	1st dist.	2d dist.	3d dist.	4th dist.	5th dist.	6th dist.	7th dist.	8th dist.	10th dist.	11th dist.	12th dist.	16th dist.	17th dist.	18th dist.	Total.
Steam:															
Whistle.....	8	5	6		5	2		1	3	30	31		3	6	100
Siren.....		1	1										1	1	4
Air:															
Whistle.....	1	5		1	1						5			1	13
Siren.....	2	3	23		5	1		1	4	7	10	5	6	16	84
Diaphone.....		1		1		1			3	1	1	1	2	4	14
Siren (electric).....									1	4			1	4	11
Reed horn.....	8	5	7	4	3			1				4	12		46
Submarine bells:															
On light vessels, driven by compressed air.....	1	7	7		7	3		2		3	4		3	2	39
On bottom, electric power.....										2					2
On buoys, operated by sea.....	1	1	2		1	2		1				1	1		10
Bell:															
Clockwork.....	37	14	59	6	66	3	1	14	5	5	9	1	4	8	232
Electric.....		5	4		3					3			1		16
Engine.....		1													1
Hand.....	12		2												14
Horn: Hand.....										1	1				2
Gun: Acetylene.....													1		1
Total.....	70	48	111	12	93	12	1	20	16	56	61	12	35	42	589

^a Auxiliary fog signals (76), whistling buoys (153), and bell buoys (347) are not included.

LIGHTS ESTABLISHED DURING THE FISCAL YEAR 1917.

[223 lights.]

District.	Location.	Order.
2d.....	Canal Channel, No. 8, Buzzards Bay, Mass.....	Lens lantern (electric incandescent).
3d.....	Hunts Point, Long Island Sound, N. Y.....	Lens lantern (acetylene).
4th.....	Tuckerton Range, Little Egg Harbor, N. J. (2 lights).....	Lens lantern.
	Delaware City, Del.....	Minor (acetylene).
	Newcastle Range Front Auxiliary, Del.....	Lens lantern.
	Rancocas River Range, N. J. (2 lights).....	Minor (acetylene).
5th.....	Craighill Channel Range Rear Lower, Md.....	Lens lantern.
	Curtis Bay, Md.....	Minor.
	Fillbates Creek Flats, York River, Va.....	Do.
	Tarpley Point Shoal, Rappahannock River, Va.....	Do.
	Tunnel Island Spit, Pocomoke Sound, Va.....	Minor (acetylene).
6th.....	Bull Spit, Coosaw River, S. C.....	Do.
	Fenwick Island Cut, South Edisto River, S. C.....	Do.
	Marsh Island Spit, St. Helena Sound, S. C.....	Do.
	Steamboat Creek, No. 2, North Edisto River, S. C.....	Do.
7th.....	Cut G Range, Tampa Bay, Fla. (2 lights).....	Lens lantern.
	Cut K Range Front, Tampa Bay, Fla.....	Do.
	Cut K Range Rear, Tampa Bay, Fla.....	Reflector.
	Hillsboro Bay Range, Fla. (2 lights).....	Lens lantern.
	Hillsboro River Range, Fla. (2 lights).....	Do.
8th.....	Bastian Bay, La.....	Minor.
	Bayou Cook, La.....	Do.
	Bayou Courant, La.....	Do.
	Port O'Connor, Matagorda Bay, Tex. (2 lights).....	Do.
	Trinity River, Tex.....	Do.
	Vermillion River Entrance, La.....	Do.
9th.....	Cucaracha, Cucaracha Passage, P. R.....	Lens lantern (oil gas).
10th.....	Grand Island Range, Niagara River, N. Y. (2 lights).....	Range lens (acetylene).
	Oswego Inner, Oswego Harbor, N. Y.....	Lens lantern.
	Rob Roy Wreck, Lake Erie, Pa.....	Minor.
11th.....	Brush Point Range Front (auxiliary), St. Marys River, Mich.....	Lens lantern (oil gas).
	Fighting Island Channel, Detroit River, Mich.....	Minor.
	Fighting Island South, Detroit River, Mich.....	Lens lantern (acetylene).
	Old Channel, Lake St. Clair, Mich. (2 lights).....	Minor.
	Pipe Island Northwest, St. Marys River, Mich.....	Do.
	Pipe Island Southeast, St. Marys River, Mich.....	Do.
	Two Harbors West Breakwater, Mich.....	Lens lantern (acetylene).
12th.....	Portage Lake Pierhead, Mich.....	Fourth (acetylene).
	Racine North Pierhead, Wis.....	Minor.
	Sheboygan North Pierhead, Wis.....	Do.
	Wolf River Entrance, Wis.....	Do.
13th.....	25 lights.....	Do.
	11 lighted spars.....	Do.
	3 float lights.....	Do.
14th.....	6 lights.....	Do.
	1 float light.....	Do.
15th.....	93 lights.....	Do.
16th.....	Cape Edwards Entrance, Kukkan Bay, Alaska.....	Minor (acetylene).
	Cape St. Elias, seacoast, Alaska.....	Third (incandescent oil vapor).
	Hanin Rocks, Kodiak Harbor, Alaska.....	Lens lantern (acetylene).
	Lyman Point, Clarence Strait, Alaska.....	Minor.
	Point Craven, Peril Strait, Alaska.....	Do.
	Spike Rock, Wrangell Strait, Alaska.....	Do.
	Susitna River Entrance, Cook Inlet, Alaska.....	Lens lantern (acetylene).
	Turn Point, Hunter Bay, Alaska.....	Minor.
	Turn Point Shoal, Wrangell Strait, Alaska.....	Do.
	Village Point, Nichols Passage, Alaska.....	Do.
	Warm Spring Bay, Chatham Strait, Alaska.....	Do.
17th.....	Bone Island, Umpqua River, Oreg.....	Do.
	Cape Horn, Columbia River, Oreg.....	Do.
	Gillihan, Willamette River, Oreg.....	Do.
	Grays Bay, Columbia River, Wash.....	Do.
	Knapp Point, Columbia River, Oreg.....	Do.
	Lower Guide Wall, Salmon Bay, Wash.....	Minor electric incandescent).
	Slaughters, Columbia River, Wash.....	Minor (acetylene).
	Slaughters Bar, Columbia River, Wash. (7 lights).....	Minor.
	West Lock, Salmon Bay, Wash.....	Lens lantern (electric incandescent).
18th.....	Horseshoe Bend Cut, Sacramento River, Cal. (3 lights).....	Minor.
	San Diego Bay, Cal. (4 lights).....	Do.
	San Diego Bay, Cal.....	Lens lantern (acetylene).
19th.....	Kipahulu, Maui Island, Hawaii.....	Do.
	Kukii Point, Kauai Island, Hawaii.....	Do.

LIGHTS WHERE ILLUMINATION WAS IMPROVED DURING THE FISCAL YEAR 1917.

FLASHING OR OCCULTING LIGHTS CHANGED FROM FIXED LIGHTS (30 LIGHTS).

District.	Location.	District.	Location.
2d.....	Handkerchief Light Vessel No. 3, Nantucket Sound, Mass.	7th.....	Egmont Key Range Rear, Gulf coast, Fla.
3d.....	Blackwells Island Reef, East River, N. Y.		Hillsboro Bay, No. 2, Tampa Bay, Fla.
	Great Captain Island, Long Island Sound, Conn.	8th.....	East Bank, Galveston Harbor, Tex.
	Jones Rocks, Long Island Sound, Conn.		Hitchcock Reef, Galveston Harbor, Tex.
	Watch Hill, Fishers Island Sound, R. I.		Houston Channel, Tex. (6 lights).
4th.....	Marcus Hook Range Front, Delaware River, Del.		Port Arthur Canal, Tex.
	Murderkill River Range, Delaware Bay, Del. (2 lights).		Sabine Pass Channel, La.
5th.....	Cape Charles Light Vessel No. 101, seacoast, Va.		Sabine Pass East Jetty, La.
	Fishing Battery, Susquehanna River, Md.		Second Turn, Galveston Harbor, Tex.
	Lower Cedar Point Beacon, Potomac River, Md.	9th.....	Southwest Pass Light Vessel No. 102, La.
	Persimmon Point Shoal, Potomac River, Md.		Mayaguez Harbor Range, P. R. (2 lights).
	Porpoise Point, Chesapeake Bay, Md.	12th.....	Michigan City West Pierhead, Ind.
	Port Tobacco River Flats, Potomac River, Md.		New Shoal Gas and Bell Buoy, Straits of Mackinac, Mich.
6th.....	Brunswick Light Vessel No. 84, seacoast, Ga.		Northwest Entrance, Sturgeon Bay Canal, Wis. (2 lights).
			Pentwater Pierhead Range Rear, Mich.
		17th.....	Pully Point, Puget Sound, Wash.
			Slip Point, Juan de Fuca Strait, Wash.

INCANDESCENT OIL-VAPOR LIGHTS CHANGED FROM OIL-WICK LIGHTS (17 LIGHTS).

2d.....	Hospital Point, Salem Harbor, Mass.	10th.....	Oswego, N. Y.
	Wood End, Cape Cod Bay, Mass.	12th.....	Chambers Island, Green Bay, Wis.
3d.....	Navesink, seacoast, N. J. (from electric arc).		Eagle Bluff, Green Bay, Wis.
	Saybrook Breakwater, Connecticut River, Conn.		Green Island, Green Bay, Wis.
4th.....	New Castle Range Front, Delaware River, Del.		Pilot Island, Lake Michigan, Wis.
8th.....	Southwest Pass Light Vessel, La. No. 102.		Plum Island Range Rear, Lake Michigan, Wis.
10th.....	Ashtabula, Ohio (from acetylene).		Sherwood Point, Green Bay, Wis.
	Galloo Island, Lake Ontario, N. Y.	17th.....	St. Joseph Pierhead Range Rear, Lake Michigan, Mich.
			Slip Point, Juan de Fuca Strait, Wash.

ACETYLENE OR OTHER LIGHTS CHANGED FROM OIL-WICK LIGHTS, ETC. (40 LIGHTS).

2d.....	Handkerchief Light Vessel No. 3, Nantucket Sound, Mass.	5th.....	Porpoise Point, Chesapeake Bay, Md.
3d.....	Blackwells Island Reef, East River, N. Y.		Port Tobacco River Flats, Potomac River, Md.
	Mill Rock Northerly, East River, N. Y.		35-Foot Channel Gas Buoys, Chesapeake Bay, Va. (2 lights).
	North Hook Beacon, New York Lower Bay, N. J. (electric).	6th.....	Brunswick Light Vessel No. 84, seacoast, Ga.
4th.....	Cherry Island Range Rear, Delaware River, Del. (electric).	7th.....	Hillsboro Bay, No. 2, Tampa Bay, Fla.
	Horseshoe Ranges West Group Lower Front, Delaware River, Pa. (electric).	8th.....	Houston Channel, No. 2, Tex.
	Horseshoe Ranges West Group Upper Front, Delaware River, Pa. (electric).		Sabine Pass East Jetty, La.
	Marcus Hook Range Front, Delaware River, Del.		Southwest Pass Range Front, La.
	Murderkill River Range, Del. (2 lights).	9th.....	Mayaguez Harbor Range, P. R. (2 lights; electric).
5th.....	Cape Charles Light Vessel No. 101, seacoast, Va.	10th.....	Strawberry Island Lower Cut Range, Niagara River, N. Y. (2 lights; acetylene to electric).
	Edenton Harbor Range, N. C. (2 lights; electric).	11th.....	Fighting Island Channel Gas Buoy, 6, Detroit River, Mich.
	Fenwick Island Shoal Light Vessel No. 52, seacoast, Del.		Grassy Island North Channel Range Rear, Detroit River, Mich. (oil-gas).
	Fishing Battery, Susquehanna River, Md.	12th.....	Michigan City West Pierhead, Ind.
	Lower Cedar Point, Potomac River, Md.		Northwest Entrance, Sturgeon Bay Canal, Wis. (2 lights).
	Persimmon Point Shoal, Potomac River, Md.		Pentwater Pierhead Range, Mich. (2 lights).
		17th.....	Pully Point, Puget Sound, Wash. (electric).
		18th.....	Goat Island, San Francisco Bay, Cal. (incandescent oil vapor to electric).
			Santa Cruz, seacoast, Cal. (electric).

LIGHTS DISCONTINUED DURING THE FISCAL YEAR 1917.

[158 lights, including float lights.]

District.	Location.	Order.
2d.....	Canal Channel, Buzzards Bay, Mass. (10 lights).....	Lens lantern (acetylene).
4th.....	New Castle Range Front Auxiliary, Del.....	Lens lantern.
5th.....	Assateague Anchorage, Va.....	Do.
	Fishing Point, Assateague Anchorage, Va.....	Do.
	Fort Macon Spit, Beaufort Harbor, N. C.....	Minor.
6th.....	Fort Clinch Range, Cumberland Sound, Fla. (2 lights).....	Reflector.
	North Island, Winyah Bay, S. C.....	Lens lantern.
7th.....	Hillsboro Bay, No. 4, Fla.....	Do.
	Hillsboro Bay Entrance Range, Fla. (2 lights).....	Minor.
	South Cut Upper, No. 8, Tampa Bay, Fla.....	Lens lantern.
8th.....	Sand Island Range Rear, Mobile Bay, Ala. (2 lights).....	Lens lantern (acetylene).
10th.....	Oswego, N. Y.....	Third.
	Rob Roy Wreck, Pa.....	Minor.
11th.....	Ecorse Range Rear, Detroit River, Mich.....	Lens lantern (oil gas).
	Grassy Island South Channel Range Front, Detroit River, Mich.....	Lens lantern.
	Grosse Isle North Channel Range Front, Detroit River, Mich.....	Do.
	Mamajuda Range Front, Detroit River, Mich.....	Do.
12th.....	Indiana Harbor Range, Ind. (2 lights).....	Lens lantern (acetylene).
	Portage Lake Pierhead Range Front, Lake Michigan, Mich.....	Lens lantern.
	Portage Lake Pierhead Range Rear, Lake Michigan, Mich.....	Fourth.
13th.....	27 lights.....	Minor.
	5 lighted spar buoys.....	Do.
14th.....	5 lights.....	Do.
15th.....	68 lights.....	Do.
16th.....	Cape St. Elias, seacoast, Alaska.....	Lens lantern (acetylene).
	North Island Rock, Orca Inlet, Alaska.....	Minor.
	Spike Rock, Wrangell Strait, Alaska.....	Do.
	Susitna River Range, Orca Inlet, Alaska (2 lights).....	Do.
17th.....	Jetty Sands Range, Columbia River (2 lights).....	Do.
	Lower Willow Bar Range, Columbia River (2 lights).....	Do.
	North Side Channel Umpqua River, Oreg.....	Do.
	Slaughters Lower and Upper Ranges, Columbia River (3 lights).....	Do.
	South Channel Range, Columbia River (2 lights).....	Reflector.
	Three Tree Island Shoal, Columbia River.....	Minor.
18th.....	Humboldt Bay Entrance Range, Cal. (2 lights).....	Lens lantern.
	Mare Island Dike, No. 8, San Pablo Bay, Cal.....	No lens (electric incandescent).
	Mare Island, Cal.....	Fourth.

GAS BUOYS ESTABLISHED AND DISCONTINUED DURING THE FISCAL YEAR 1917.

District.	Location.	District.	Location.
	ESTABLISHED (73).		ESTABLISHED—continued.
1st.....	Southeast Rock (whistle), seacoast, Me.	5th.....	Barge Tangier Wreck, York River Entrance, Va.
2d.....	Arthur James Wreck, Boston Harbor, Mass.		Barge Wreck, Curtis Bay, Md.
	Canal Channel, Buzzards Bay, Mass. (8 buoys).		Coronet Wreck, Chesapeake Bay, Md.
	Graves (whistle), Boston Harbor, Mass.		Florence O'Brien Wreck, Sassafras River Entrance, Md.
	Hercules Wreck, Boston Harbor, Mass.		Henry S. Lawson Wreck, Chesapeake Bay, Md.
	Marguerite Wreck, Boston Harbor, Mass.		Naval Target Wreck, Rappahannock Spit, Va.
3d.....	Conaskonk Point Shoal, Raritan Bay, N. J.		Powhatan Wreck, Hampton Roads, Va.
	Grandma Coal Barge Wreck, Long Island Sound, Conn.		Powhatan Wreck (bell), Hampton Roads, Va.
	Popasquash Point (bell), Narragansett Bay, R. I.		Schooner Wreck, Chesapeake Bay, Md.
4th.....	Tunkhannock Wreck, seacoast, N. J.	7th.....	Sewall Point Shoal (bell), Hampton Roads, Va.
	Ben Davis Point Shoal (bell), Delaware Bay, N. J.		Key West (whistle), Fla.
	Cedar Creek, Delaware River, Del.		Miami, Fla.
	Hamburg, Delaware River, Del.	8th.....	Seahorse Reef, Gulf coast, Fla.
	Middle Ground, Delaware River, Del.		Brazos River, Tex.
	Pike Coal Barge Wreck, Delaware River, Pa.		Brazos River Entrance (whistle), Tex.
			Caucus Cut (whistle), Pensacola Bay Entrance, Fla.
			Middle Ground, Mobile Bay, Ala.

GAS BUOYS ESTABLISHED AND DISCONTINUED DURING THE FISCAL YEAR 1917—
Continued.

District.	Location.	District.	Location.
	ESTABLISHED—continued.		DISCONTINUED—continued.
8th	Mobile Bar, Ala. (3 buoys).	2d	Hercules Wreck, Boston Harbor, Mass.
	Mobile Entrance (whistle), Ala.		Marguerite Wreck, Boston Harbor, Mass.
9th	West Bank, Mobile Bay, Ala.	3d	Grandma Coal Barge Wreck, Long Island Sound, Conn.
	Manchas Grandes, Mayaguez Harbor, P. R.		Tunkhannock Wreck, seacoast, N. J.
	San Augustin Shoal, San Juan Harbor, P. R.	4th	Ben Davis Point Shoal, Delaware Bay, N. J.
10th	Kelley Island Shoal North Side, Lake Erie, Ohio.		Middle Ground, Delaware River, Del.
	Shenango Wreck, Conneaut Harbor, Ohio.		Pike Coal Barge Wreck, Delaware River, Pa.
11th	Calcite, Lake Huron, Mich.	5th	Barge Ivie Wreck, Elizabeth River, Va.
	Fighting Island Channel, Detroit River, Mich. (2 buoys).		Barge Wreck, Curtis Bay, Md.
	Lake St. Clair, Mich. (2 buoys).		Coronet Wreck, Chesapeake Bay, Md.
	Pipe Island Shoal, St. Marys River, Mich.		Emma F. Angell Wreck, seacoast, Va.
	Pipe Island Twins, St. Marys River, Mich.		Florence O'Brien Wreck, Sassafas River Entrance, Md.
12th	Squaw Island, St. Marys River, Mich.		Henry S. Lawson Wreck, Chesapeake Bay, Md.
	Gravelly Island Shoal (bell), Lake Michigan, Mich.		Naval Target Wreck, Rappahannock Spit, Va.
	North Bank, Indiana Harbor, Ind.		Schooner Wreck, Chesapeake Bay, Md.
	Outer Shoal (bell), Lake Michigan, Wis.		Sewall Point Shoal (bell), Hampton Roads, Va.
	West Bank, Green Bay Harbor, Wis.		Shamokin Wreck, Hampton Roads Approach, Va.
16th	West Bank, Indiana Harbor, Ind.		Tarpley Point Shoal (bell), Rappahannock River, Va.
	Channel Rock, Sitka Sound, Alaska.		Tunnel Island (bell), Pocomoke Sound, Va.
	North Rock Shoal, Orca Inlet, Alaska.	7th	Key West, Fla.
	Orca Inlet, Prince William Sound, Alaska.		Port Inglis (whistle), Fla.
	Potter Rocks, Tongass Narrows, Alaska.	8th	Galveston Bay, Tex.
	Poundstone Rock (bell), Favorite Channel, Alaska.		Middle Ground, Mobile Bay, Ala.
	Reef Island Reef, Prince William Sound, Alaska.	10th	Shenango Wreck, Conneaut Harbor, Ohio.
17th	Clatsop Spit, Columbia River, Oreg.	11th	Fighting Island Channel, Detroit River, Mich.
	Duwamish Head (bell), Seattle Harbor, Wash.		Twenty-Foot Channel, Lake St. Clair, Mich. (4 buoys).
	Grays Harbor Outside Bar (whistle), Wash.		Watson Reefs, St. Marys River, Mich.
18th	North Spit (bell), Humboldt Bay, Cal.	12th	East Bank, Indiana Harbor, Ind.
	San Pablo Dredged Channel, San Pablo Bay, Cal. (2 buoys).		Middle Shoal, Lake Michigan, North End, Mich.
	DISCONTINUED (40).		West Bank, Indiana Harbor, Ind.
2d	Arthur James Wreck, Boston Harbor, Mass.	17th	South Jetty (whistle), Columbia River Entrance, Oreg.
	Canal Breakwater (bell), Cape Cod Canal Approach, Mass.	18th	City of Panama Wreck, San Francisco Bay, Cal.
	Canal Channel, Buzzards Bay, Mass. (3 buoys).		

FOG SIGNALS ESTABLISHED, IMPROVED, AND DISCONTINUED DURING THE FISCAL YEAR 1917.

District.	Location.	Character.	
ESTABLISHED (7).			
2d.....	Canal Channel, No. 8, Buzzards Bay, Mass.	Bell operated by electricity.	
8th.....	Timbalier, Gulf coast, La.....	Bell operated by machinery.	
10th.....	Cleveland West Pierhead, Ohio.....	Air diaphone.	
11th.....	Eagle River Shoals, Lake Superior, Mich.	Electric siren.	
12th.....	Manistique, Lake Michigan, Mich.....	Air diaphone.	
	Sheboygan Breakwater, Lake Michigan, Mich.	1st-class air siren.	
16th.....	Cape St. Elias, seacoast, Alaska.....	Do.	
IMPROVED (15).			
1st.....	Petit Manan, seacoast, Me.....	From—	To—
2d.....	Handkerchief Light Vessel No. 3, Nantucket Sound, Mass.	10-inch steam whistle.	10-inch air whistle.
	Race Point, Cape Cod Bay, Mass.....	Bell or horn (hand).	Bell operated by machinery.
3d.....	Race Rock, Block Island Sound, N. Y.....	Steam whistle.	Air whistle.
4th.....	Fort Mifflin, Delaware River, N. J.....	3d-class reed horn.	1st-class air siren.
	Fort McHenry, Baltimore Harbor, Md.	Bell operated by machinery.	Electric air siren.
	Old Point Comfort, Hampton Roads, Va.	Bell operated electrically.	Electric air siren.
8th.....	Southwest Pass Light Vessel No. 102, La.	Bell operated by machinery.	Bell operated by electricity.
10th.....	Ashtabula, Lake Erie, Ohio.....	12-inch steam whistle.	1st-class air siren.
11th.....	Passage Island, Lake Superior, Mich...	1st-class air siren.	Air diaphone.
16th.....	Scotch Cap, Unimak Pass, Alaska.....	Steam whistle.	Do.
17th.....	Cape Flattery, seacoast, Wash.....	10-inch air whistle.	Do.
	Slip Point, Juan de Fuca Strait, Wash..	Air siren.	Do.
18th.....	Farallon, seacoast, Cal.....	3d-class reed horn.	Do.
	Point Conception, seacoast, Cal.....	Air siren.	Do.
		Steam whistle.	Do.
DISCONTINUED (3).			
10th.....	Cleveland West Breakwater, Ohio.....	10-inch steam whistle.	
12th.....	Sheboygan North Pierhead, Wis.....	Do.	
18th.....	Mare Island, Cal.....	Bell operated by machinery.	

SUBMARINE SIGNALS DISCONTINUED DURING THE FISCAL YEAR 1917.

District.	Location.
12th.....	White Shoal, Straits of Mackinac, Mich.

PRIVATE AIDS TO NAVIGATION MAINTAINED ON JUNE 30, 1917.

[Under the act of June 20, 1906.]

District.	Lights.	Buoys.		Other unlighted aids.	Fog signals.	Total.
		Lighted.	Unlighted.			
1st.....			33	3		36
2d.....	43		34	12		89
3d.....	28	6	95	8	2	139
4th.....		1	12			13
5th.....	16	6	120	68	3	213
6th.....			1			1
7th.....	4		9	2		15
8th.....	12		23	12		47
9th.....			3			3
10th.....	20	1	3	1	2	27
11th.....	13	2	54	1		70
12th.....	32	3	8		7	50
13th.....		1				1
14th.....	1					1
16th.....	2		1			3
17th.....	4		15		2	21
18th.....	23	2	2	1	10	38
19th.....	20		3	2		25
Total.....	218	22	416	110	26	792

BRIDGES OVER NAVIGABLE WATERS LIGHTED ON JUNE 30, 1917.

[Under the act of Aug. 7, 1882, 22 Stat., 309.]

District.	Lighted bridges.	District.	Lighted bridges.	District.	Lighted bridges.
1st.....	19	8th.....	260	15th.....	8
2d.....	63	9th.....	1	17th.....	53
3d.....	181	10th.....	51	18th.....	29
4th.....	16	11th.....	53		
5th.....	152	12th.....	167	Total.....	1,234
6th.....	54	13th.....	75		
7th.....	24	14th.....	180		

AIDS MAINTAINED UNDER CONTRACT DURING THE FISCAL YEAR 1917.

District.	Name of aids.	Annual cost.
1st.....	Kennebunkport Pier Light, Me.....	\$150.00
6th.....	Little River Inlet, N. C. (4 bar buoys).....	1.00
10th.....	Lake Ontario and the St. Lawrence River, N. Y. (41 buoys).....	1,900.00
	Niagara River and Black Rock Channel, N. Y. (74 buoys).....	600.00
11th.....	Superior Bay, St. Louis Bay and River, Wis. and Minn. (32 lights).....	2,200.00
12th.....	Fox River, Wis. (14 spar buoys); Green Bay, Wis. (18 spar and 2 gas buoys).....	160.00
16th.....	Cooks Inlet, Alaska (2 lights).....	93.00
	St. Michael Canal and Apoon Pass, Alaska (32 buoys), and Orizaba Reef Bell Buoy.....	388.50
	Norton Sound (12 lights).....	630.00
18th.....	Hookton Channel Range Rear Light, Cal.....	1.00

LIGHT VESSELS IN COMMISSION DURING THE FISCAL YEAR 1917.

Number.	Station.	District.	Tonnage.		When built.	Material of hull.	Dimensions.			Indicated horsepower (self-propelling).		Regular complement.		Fog signal.	Illuminant.	Cost of repairs made during fiscal year.		Original cost.	On station.	
			Gross.	Net.			Length over all.	Breadth.	Depth.			Officers.	Crew.						Months.	Days.
71	Portland, Me.	1	a 495		1902	Wood.	Fl. in. 129 9	Fl. in. 28 6	Fl. in. 13 0	380	4	4	8	12" steam whistle ^b	Acet.	\$1,817	\$10,134	\$88,896	10	24
3	Handkerchief, Mass.	2	140		1852	do.	e 69 4	23 0	10 0	(d)	2	2	5	Bell	do.	7,303	4,331	12,000	6	24
4	Relief	2	104		1855	do.	e 77 0	20 0	10 0	(d)	1	1	0	Bell or horn	Oil	1,244	3,846		7	2
5	Stone Horse Shoal, Mass.	2	104		1864	do.	e 80 6	21 6	9 0	(d)	2	2	1	8" air whistle	do.	663	6,275		10	4
6	Cross Rip, Mass.	2	120		1852	do.	e 80 0	24 0	10 0	(d)	2	2	1	do.	Acet.	45	6,172		12	0
9	Hedge Fence, Mass.	2	104		1857	do.	e 81 2	28 2	9 6	(d)	2	2	1	do.	Oil	158	6,029	19,883	12	0
41	Vineyard Sound, Mass.	2	387		1876	do.	120 6	26 9	11 0	(d)	2	2	7	First-class air siren ^b	do.	382	6,505	33,000	12	0
42	Hen and Chickens, Mass.	2	410		1877	do.	121 7	26 6	10 6	(d)	3	3	7	10" air whistle	do.	116	8,359	40,796	12	0
47	Pollock Rip, Mass.	2	a 470		1891	Comp.	120 10	26 6	11 0	(d)	4	4	6	12" steam chime wh. ^b	do.	3,282	9,131	60,000	6	18
54	Boston, Mass.	2	310		1892	Steel.	118 10	26 0	11 0	150	4	4	7	First-class air siren ^b	Inc. o. v.	964	10,837	62,030	11	16
66	Relief	2	a 590		1896	Comp.	123 0	28 6	13 0	350	2	2	6	12" steam chime wh. ^b	Ei or o.	3,968	8,441	69,282	4	0
73	Pollock Rip Shoal, Mass.	2	a 538		1901	Steel.	123 9	28 6	12 9	400	4	4	8	do.	Oil	1,253	11,911	79,872	10	28
85	Nantucket Shoals, Mass.	2	a 683	246	1907	do.	135 5	29 0	13 0	340	5	10	8	do.	Ei. inc.	4,752	15,149	99,000	8	1
86	Great Round Shoal, Mass.	2	a 683	246	1907	do.	135 5	29 0	13 0	340	4	8	8	do.	Oil	993	11,216	99,000	10	11
90	Relief.	2	a 685	225	1908	do.	135 5	29 6	13 0	400	2	2	6	do.	do.	866	8,432	107,213	8	16
11	Scotland, N. J.	3	320		1853	Wood.	e 104 0	24 8	11 6	(d)	2	2	6	Bell	Oil and oil gas.	982	5,945	13,462	11	3
13	Bartlett Reef, Conn.	3	155		1854	do.	e 79 8	21 8	10 4	(d)	2	2	5	do.	Oil	30	5,066	12,000	12	0
16	Relief.	3	250		1854	do.	e 103 6	22 6	11 0	(d)	0	0	1	First-class air siren, 6" whistle. ^b	do.	5,039	1,578	28,084	10	6
20	do.	3	165		1867	do.	e 81 6	21 6	10 0	(d)	0	0	1	Bell	do.	99	945	25,040	0	0
23	Ram Island Reef, Conn.	3	186		1857	do.	e 94 2	24 0	9 0	(d)	2	2	5	do.	do.	4	4,980	7,500	12	0
39	Brenton Reef, R. I.	3	387		1875	do.	119 6	26 9	13 0	(d)	4	4	6	12" and 6" steam wh. ^b	do.	1,141	5,448	42,200	7	20
44	Northeast End, N. J.	3	197		1882	Iron.	115 6	25 0	10 6	(d)	4	4	7	First-class steam siren ^b	Acet.	2,280	9,545	50,000	10	19
48	Cornfield Point, Conn.	3	a 470		1891	Comp.	120 10	27 8	12 0	(d)	3	3	7	First-class air siren ^b	Acet.	2,347	8,134	52,780	11	2
51	Relief.	3	283		1892	Iron.	118 10	26 9	11 0	135	2	2	5	12" steam whistle ^b	and oil.	1,296	6,901	53,325	5	8
68	Fire Island, N. Y.	3	a 590	204	1897	Comp.	122 10	28 6	12 6	350	4	10	10	12" steam chime wh. ^b	Ei. inc.	2,402	13,032	74,750	8	15
69	Overfalls, Del.	3	a 590	204	1897	do.	122 10	29 6	13 0	350	4	10	10	do.	do.	25,283	12,802	79,500	5	27
78	Relief	3	a 668	188	1904	Steel.	129 0	28 6	12 6	325	2	2	5	12" steam whistle ^b	Oil or acet.	3,475	7,177	89,030	9	27
79	Five-Fathom Bank, N. J.	3	a 668	188	1904	do.	129 0	28 6	12 6	325	4	4	8	12" steam chime wh. ^b	Oil.	4,656	10,716	89,000	7	16
87	Ambrose Channel, N. Y.	3	a 683	246	1907	do.	135 5	29 0	13 0	325	4	4	10	12" steam whistle ^b	Ei. arc.	1,284	14,217	99,000	11	10

	Relief.	210	1849	Wood.	98	25	0	9	0	(d)	2	6	Bell.	Oil.	93	89	12,402	0	0
2	Relief.	210	1849	Wood.	98	25	0	9	0	(d)	2	6	8" air chime whistle b.	Oil.	93	89	12,402	0	0
43	Thirty-Five Foot Channel, Va.	210	1887	Steel	124	27	6	12	0	(d)	4	6	12" steam whistle b.	do.	783	6,007	55,500	12	0
46	Tail of the Horseshoe, Va.	210	1887	do.	124	27	6	12	0	(d)	4	6	do.	do.	712	5,562	60,000	11	4
49	Relief	210	1890	Comp.	120	27	0	14	0	(d)	2	3	do.	do.	20,765	8,150	57,900	4	8
52	Fenwick Island Shoal, Del.	210	1892	Iron.	118	26	6	12	0	180	4	8	First-class air siren b.	Acet.	6,084	9,587	62,000	7	28
71	Diamond Shoal, N. C.	210	1897	Comp.	122	28	6	13	0	350	5	10	12" steam chime wh. b.	Fl. inc.	7,322	12,322	70,700	9	9
72	Relief	210	1900	Steel.	123	28	6	14	0	350	5	10	do.	do.	5,714	11,932	89,000	7	28
80	Cape Lookout Shoals, N. C.	210	1904	do.	129	28	6	12	6	500	4	10	do.	Oil.	1,661	11,363	85,000	11	0
91	Winter-Quarter Shoal, Va.	210	1908	do.	135	29	0	13	0	400	4	8	do.	Acet.	675	11,091	107,213	9	21
97	Bush Bluff, Va.	210	1876	Comp.	80	19	5	12	0	(f)	1	2	Bell.	Oil gas.	171	2,174	107,213	12	0
101	Cape Charles, Va.	210	1916	Steel.	101	25	0	13	2	200	4	7	First-class air siren b.	Acet.	572	8,280	108,507	6	2
1	Martins Industry, S. C.	275	1855	Wood.	103	24	0	13	0	(d)	2	8	do.	Oil.	1,348	7,326	...	10	17
34	Charleston, S. C.	150	1864	do.	101	23	0	10	0	(d)	2	6	Air diaphone.	Acet.	458	5,268	48,000	8	16
53	Relief	310	1892	Iron.	119	26	6	11	0	135	3	5	12" steam whistle b.	do.	1,260	9,529	61,538	9	16
84	Brunswick, Ga.	246	1907	Steel.	135	29	0	13	0	325	4	8	do.	Oil.	10,267	10,291	99,000	8	26
94	Frying Pan Shoals, N. C.	229	1911	do.	135	29	0	13	0	363	4	10	12" steam chime wh. b.	Inc. o. v.	810	12,139	104,604	10	16
43	Relief.	191	1881	Comp.	118	25	0	12	0	(d)	4	6	12" steam whistle b.	Oil.	335	6,429	50,000	5	13
81	Herald Bank, Tex.	268	1904	Steel.	129	28	6	12	6	325	4	8	do.	do.	2,542	11,273	90,000	8	17
102	Southwest Pass, La.	360	1916	do.	101	25	0	13	2	200	4	7	First-class air siren b.	Inc. o. v.	199	5,727	110,085	4	5
98	Buffalo, N. Y.	195	1915	do.	101	23	6	11	5	100	4	2	do.	Fl. inc.	706	5,430	87,025	7	4
61	Lake Huron, Mich.	105	1893	Wood.	87	21	0	9	0	(d)	3	3	6" steam whistle b.	Oil.	340	4,254	14,098	6	15
62	Bar Point Shoal, Mich.	105	1893	do.	87	21	6	8	0	(d)	3	3	do.	do.	800	4,494	14,098	6	0
75	Lake St. Clair, Mich.	160	1902	Steel.	83	24	0	4	9	(d)	2	2	Bell.	do.	384	2,995	14,983	7	27
82	Relief	209	1912	do.	95	21	0	8	11	90	4	2	10" steam whistle	Acet.	9,040	7,775	42,910	3	10
89	Martin Reef, Mich.	205	1908	do.	88	21	0	10	0	90	4	2	6" steam whistle b.	Oil.	127	5,406	37,500	7	12
96	Free Reef, Mich.	170	1914	do.	101	23	6	11	5	(f)	3	3	First-class air siren b.	Fl. inc.	998	4,621	71,292	6	23
55	Lansing Shoal, Mich.	129	1891	Wood.	102	20	0	9	0	100	4	2	6" steam whistle b.	Oil.	369	6,160	13,600	7	12
56	North Manitowish Shoal, Mich.	130	1891	do.	102	20	0	8	10	100	4	2	do.	do.	7,798	5,265	13,600	6	18
57	Grays Reef, Mich.	130	1891	do.	102	20	0	8	10	100	4	2	do.	do.	5,590	5,673	13,600	7	12
60	Eleven-Foot Shoal, Mich.	105	1893	do.	87	21	6	8	6	(d)	3	3	10" steam whistle b.	do.	2,470	5,070	13,990	6	13
77	Pelee Reef, Wis.	155	1906	Steel.	75	21	6	4	0	(d)	2	3	8" air chime whistle	do.	166	4,030	13,990	7	1
95	Milwaukee, Wis.	368	1912	do.	108	23	0	10	2	200	4	5	12" steam whistle	Fl. inc.	672	9,314	74,558	9	21
67	Unadilla Reef, Wash.	450	1897	Comp.	122	28	6	13	0	200	4	10	do.	Oil.	285	14,020	69,750	9	24
88	Columbia River, Ore.	246	1907	Steel.	135	29	0	13	0	325	4	10	do.	do.	2,688	13,611	99,000	8	12
92	Relief	225	1908	do.	135	29	0	13	0	400	2	5	do.	do.	2,109	12,105	107,213	8	24
93	Swainsboro Bank, Wash.	225	1908	do.	135	29	0	13	0	400	4	11	do.	do.	1,329	15,515	107,213	9	0
70	San Francisco, Cal.	590	1897	Comp.	122	28	6	13	0	349	4	11	do.	Fl. inc.	176	14,865	79,000	7	11
76	Relief	578	1904	Steel.	129	28	8	12	0	380	2	5	do.	Oil.	1,185	13,988	90,000	8	16
83	Blunts Reef, Cal.	668	1904	do.	129	28	6	13	0	380	4	10	do.	do.	3,177	14,551	90,000	8	15

^a Displacement (salt water).
^b Submarine signal.

^c Length between perpendiculars.
^d Sail.

^e Wood sheathed.
^f No means of propulsion.

^g Displacement (fresh water).
^h Equipped with radio.

TENDERS OF THE LIGHTHOUSE SERVICE IN COMMISSION DURING THE FISCAL YEAR 1917.

Name.	District.	Displacement.		When built.	Description.	Material of hull.	Dimensions.			Mean draft.		Indicated horsepower.	Regular complement.		Miles steamed.	Coal consumed for all purposes.	Cost of repairs.	Cost of maintenance.	(Original cost.
		Light.	Tons.				Length overall.	Breadth.	Depth.	Light.	Loaded.		Officers.	Crew.					
Hibiscus.....	1	818	1,081	1908	Steamer, twin screw...	Steel...	190	30	16	11	13	1,000	6	25	16,754	2,117	\$2,261	\$42,343	\$181,643
Zizania.....	1	575	643	1888	do.	Iron...	161	27	12	8	9	650	5	22	9,914	1,125	3,473	32,587	45,719
Anemone.....	2	818	1,053	1908	do.	Steel...	190	30	16	11	13	1,000	6	25	12,956	1,719	1,733	40,552	191,999
Azalea.....	2	330	516	1891	Steamer, single screw...	do.	154	25	12	6	9	400	5	21	11,174	1,014	2,017	30,072	79,792
Mayflower.....	2	630	668	1897	Steamer, twin screw...	do.	164	30	12	7	9	650	5	24	10,306	1,536	2,814	33,850	74,872
Daisy.....	3	61	81	1892	Steamer, single screw...	Wood...	80	14	5	4	5	60	2	4	8,154	157	697	7,357	6,500
Gardenia.....	3	217	245	1879	do.	do.	117	20	9	6	6	200	4	11	6,831	377	515	12,380	11,000
John Rodgers.....	3	455	571	1883	Steamer, side wheel...	Iron...	160	27	9	6	7	260	4	18	5,821	650	1,901	21,463	59,987
Larkspur.....	3	738	888	1903	Steamer, twin screw...	Steel...	160	30	14	9	10	750	6	24	1,041	154	65,403	10,142	125,259
Mistletoe.....	3	455	476	1872	Steamer, side wheel...	Wood...	160	26	9	6	9	370	4	18	7,439	635	1,448	20,214	45,833
Pansy.....	3	431	454	1878	Steamer, twin screw...	Iron...	152	25	11	7	7	250	4	19	12,875	1,042	2,100	23,019	48,789
Tulip.....	3	774	1,142	1908	do.	Steel...	190	30	16	10	13	1,000	6	25	16,456	2,160	2,200	36,770	191,658
Myrtle.....	3	435	542	1872	Steamer, single screw...	Wood...	140	25	11	9	11	225	4	17	14,939	1,239	3,533	26,388	44,500
Iris.....	4	519	606	1897	do.	Steel...	153	30	10	8	9	800	4	19	10,138	1,250	5,493	27,419	84,407
Woodbine.....	4	85	107	1913	Gasoline, single screw...	Wood...	95	16	7	5	5	125	2	4	7,537	{ 14,997 }	1,983	10,279	24,728
Arbutus.....	5	398	545	1879	Steamer, twin screw...	do.	153	25	11	7	9	360	5	20	8,801	878	2,050	27,908	49,769
Holly.....	5	431	499	1881	Steamer, side wheel...	Comp.	176	24	10	7	8	400	5	18	9,370	757	1,140	21,244	41,911
Jessamine.....	5	369	403	1881	do.	Iron...	155	24	10	7	9	350	4	16	7,533	760	1,018	20,280	41,911
Juniper.....	5	125	146	1903	Steamer, twin screw...	Steel...	95	18	8	4	5	280	2	9	5,944	368	5,621	10,886	29,425
Laurel.....	5	218	290	1915	Steamer, single screw...	Wood...	105	22	9	6	10	160	4	11	9,155	396	2,548	14,184	55,502
Maple.....	5	567	799	1893	Steamer, twin screw...	Steel...	164	30	12	7	9	650	6	22	11,325	1,319	8,332	30,602	93,809
Orchid.....	5	818	1,081	1908	do.	do.	190	30	16	11	13	1,000	7	25	16,981	2,103	3,170	36,555	186,151
Cypress.....	6	716	1,060	1908	do.	do.	190	30	16	10	13	1,000	7	25	18,191	2,174	4,167	42,490	191,653
Mangrove.....	6	549	682	1897	do.	do.	164	30	12	7	8	550	5	24	12,749	1,539	3,237	32,938	74,998

Palmetto.....	6	156	166	1917	Gasoline, twin screw.....	do.....	90	22	8	3	8	3	11	150	3	8	2,056	{ ^e 5,005 4	63	5,574	27,087
Water Lilly.....	6	29	39	1895	do.....	Wood.	64	11	5	2	11	3	8	36	2	2	5,820	{ ^e 3,780 4	6	5,274	9,261
Ivy.....	7	736	916	1904	Steamer, twin screw.....	Steel...	173	30	13	8	5	9	6	700	5	22	3,806	553	46,108	20,637	123,860
Snowdrop.....	7	30	41	1896	Gasoline, twin screw..	Wood.	69	11	5	3	1	3	7	32	2	2	5,383	{ ^e 4,310 2	1,043	4,915	9,700
Camellia.....	8	276	377	1911	Steamer, twin screw..	Steel...	117	24	10	5	10	7	7	280	4	17	5,223	617	221	19,538	57,412
Magnolia.....	8	685	877	1904	do.....	do.....	173	30	13	7	6	9	2	700	5	24	12,686	1,954	1,384	31,992	124,874
Sunflower.....	8	728	986	1907	do.....	do.....	174	31	15	9	8	12	1	900	6	26	9,850	1,516	5,123	34,091	124,958
Lilac.....	9	464	643	1892	Steamer, single screw..	do.....	155	27	15	10	6	12	3	800	5	19	4,924	510	16,895	5,129	92,125
Crocus.....	10	/681	/1,000	1904	Steamer, twin screw..	do.....	165	29	14	9	6	10	6	700	6	21	7,866	1,577	3,726	27,388	119,718
Amaranth.....	11	/597	/975	1892	Steamer, single screw..	do.....	166	28	14	8	6	12	6	672	5	20	9,413	1,280	3,110	27,342	74,994
Aspen.....	11	/353	/415	1906	do.....	do.....	126	25	12	7	3	8	3	440	4	10	8,695	601	1,400	15,507	70,573
Clover.....	11	/163	/205	1899	do.....	Wood.	93	22	7	5	4	6	4	140	4	8	9,914	378	607	12,626	.....
Marigold.....	11	/477	/696	1890	do.....	Iron...	160	27	12	8	5	11	0	550	5	20	11,751	937	1,459	26,658	84,871
Hyacinth.....	12	/493	/914	1903	do.....	Steel..	165	28	14	7	0	11	6	500	5	20	7,896	1,275	3,656	26,849	115,000
Sumac.....	12	/500	/887	1903	Steamer, twin screw..	do.....	169	30	13	8	5	11	9	700	5	23	8,494	1,450	2,835	32,248	114,992
Dandelion.....	13	/232	/302	1893	Steamer, stern wheel..	Wood.	140	31	5	2	6	3	3	500	4	13	1,199	399	.....	4,934	23,174
Goldenrod ^a	14	/194	/283	1888	do.....	Steel..	169	27	4	2	5	3	4	152	.....	.....	.....	.....	.....	.....	33,221
Oleander.....	15	/463	/548	1903	do.....	do.....	189	34	7	3	10	4	6	600	3	17	15,613	2,234	878	25,271	60,000
Kukul.....	16	838	935	1908	Steamer, twin screw..	do.....	190	30	16	11	2	12	0	1,000	7	22	12,760	2,542	5,122	58,238	213,880
Fern.....	16	245	317	1915	Steamer, single screw..	Wood.	112	22	10	7	1	8	6	300	4	8	12,573	3,106	3,800	18,605	62,100
Cedar.....	16	1,245	1,890	1917	do.....	Steel..	201	36	18	9	6	13	6	1,455	7	22	.....	.....	.....	.....	248,189
Heather.....	17	631	831	1903	do.....	do.....	179	28	15	9	6	11	6	685	6	19	8,685	1,181	4,366	32,010	118,568
Manzanita.....	17	774	1,000	1908	Steamer, twin screw..	do.....	190	30	16	10	7	12	7	1,000	6	23	10,771	1,432	5,094	35,052	211,817
Rose.....	17	395	567	1916	do.....	do.....	127	24	11	7	0	9	4	330	4	16	6,940	1,075,522	726	20,287	92,135
Madrono.....	18	654	806	1885	Steamer, single screw..	Iron...	180	27	15	9	9	11	6	750	6	19	9,697	1,124	1,923	36,273	87,872
Sequoia.....	18	809	1,100	1908	Steamer, twin screw..	Steel..	190	30	16	10	11	13	5	1,000	7	23	10,460	1,351	662	43,427	213,499
Columbine.....	19	429	643	1892	Steamer, single screw..	do.....	155	27	15	9	6	12	3	800	6	19	9,254	800	4,155	36,817	93,993

^a Light—without cargo and deck loads, and a minimum supply of stores, provisions, water, and coal or oil.

^b Loaded—bunkers or fuel-oil tanks full of coal or oil, all tanks, including trimming tanks, full of water; full stores and provisions, and an average maximum cargo and deck load.

^c Laid up Mar. 1, 1917.

^d Length between perpendiculars.

^e Gallons gasoline.

^f Displacement (fresh water).

^g In use by U. S. Engineer Department.

^h Gallons of fuel oil.

ⁱ Placed in commission June 30, 1917.

⊙ Equipped with radio.

CONSTRUCTION OF TENDERS AND LIGHT VESSELS.

Tender "Palmetto."—Acts of May 27, 1908, and March 4, 1909, appropriated \$200,000 for one tender, and the acts of July 27, 1912, and March 3, 1915, authorized the use of this amount for the construction of two or more tenders for general service. Plans were prepared for a light-draft tender for use in the inside waters of the sixth district, and on September 3, 1915, a contract was awarded to the Merrill-Stevens Co., Jacksonville, Fla., in the sum of \$28,975. The vessel was launched June 30, 1916, and was completed and placed in commission March 19, 1917. Amount expended to June 30, 1917, \$27,687.20.

Tender.—The act of May 27, 1908, appropriated \$30,000 for a tender for the engineer sixth lighthouse district or elsewhere. Expenditures for plans under this appropriation amounted to \$3,133.36, but owing to the rapid advance in the cost of labor and material it was found impossible to construct a vessel from the available balance. Bids were invited for the purchase of a suitable vessel for use in the thirteenth district, and a contract was entered into on March 7, 1917, for the purchase of the stern-wheel river steamer *F. Weyerhaeuser*, at a cost of \$19,300. The vessel was placed in commission April 6, 1917, and renamed *Dandelion*. Amount expended to June 30, 1917, \$23,173.90 for tender *Dandelion*. Total expended from appropriation, \$26,307.26.

Tender "Rose."—Acts of May 27, 1908, and March 4, 1909, appropriated \$200,000 for one tender, and the act of July 27, 1912, authorized the use of this amount for the construction of two tenders for general service. As one of these, plans and specifications were completed for a tender of moderate size and draft for use in the small harbors and inside waters of the coasts of Oregon and Washington, and on November 6, 1914, a contract was awarded for its construction to Anderson Steamboat Co., Seattle, Wash., in the sum of \$87,950. The vessel was launched February 19, 1916, and was completed and placed in commission August 8, 1916.

Tender "Cedar."—The act of January 25, 1915, appropriated \$250,000 for a lighthouse tender for general service. Plans and specifications were immediately prepared for a first-class seagoing tender, for service in Alaska, and on May 4, 1915, a contract was awarded for its construction to the Craig Shipbuilding Co., Long Beach, Cal., in the sum of \$234,500. The vessel was completed and placed in commission June 30, 1917. Amount expended to June 30, 1917, \$245,443.88.

Tender "Aster" and barge.—The act of July 1, 1916, appropriated \$20,000 for constructing or purchasing and equipping a small tender and barge for the eighth district, Texas and Louisiana. It was proposed to purchase a suitable vessel for a tender, and construct the barge from plans and specifications now in preparation. Bids were twice invited for the purchase of a suitable vessel, without satisfactory results owing to the scarcity of vessels caused by war conditions. It is proposed to invite bids again when conditions become more normal. Amount expended to June 30, 1917, \$13.14.

Power derrick barge.—The act of July 1, 1916, appropriated \$100,000 for aids to navigation, Hudson River, N. Y. It was found that in the construction of these aids a light-draft power barge with derrick was required. A suitable barge available for purchase could not be found, and accordingly plans and specifications were prepared for a wooden power derrick barge, and on January 13, 1917, a contract was awarded to Rice Bros., East Boothbay, Me., for its construction, in the sum of \$29,400. The keel, stem, sternpost, and frames were partly completed when, on July 10, 1917, a disastrous fire occurred at the plant of the above concern, destroying all but four frames, the keel, stem, and sternpost being uninjured.

Radio equipment for seagoing vessels.—The act of August 28, 1916, authorized the furnishing of all seagoing vessels in the Lighthouse Service with radio equipment and auxiliary power for the operation thereof, at a cost of \$60,000, and the act of June 12, 1917, appropriated \$60,000 for the purpose. Steps have been taken, in cooperation with the Navy Department, to purchase the apparatus and equip all seagoing tenders of this Service. The apparatus has been ordered, and the work of installation will probably be completed by January 1, 1918.

Tender.—The act of June 12, 1917, appropriated \$150,000 for a lighthouse tender for the third district to replace the tender *Gardenia* or for general service. Plans and specifications are in preparation, but no expenditures were made to June 30, 1917.

Light vessel "No. 99."—The act of August 24, 1912, appropriated \$130,000 for a light vessel for general service. Plans and specifications were prepared for a light vessel for the Great Lakes. Bids were received on May 25, 1916, and on June 29, 1916, a contract was awarded to Rice Bros., East Boothbay, Me., in the sum of \$61,000. Amount expended to June 30, 1917, \$28,329.42. The construction of the vessel had reached a degree of completion of approximately 53 per cent on June 30, 1917. On July 10, 1917, a disastrous fire occurred at the builders' plant in which the vessel and the greater part of its fittings were rendered a total loss.

Light vessel "No. 100."—Plans and specifications are in preparation for a large light vessel for station at Nantucket Shoals, Mass. There is a balance of approximately \$51,600 remaining under the appropriation of August 26, 1912, for light vessels, but on account of the present excessively high cost of materials it will not be possible to construct the vessel from this available balance. No expenditures were made to June 30, 1917.

Light vessel "No. 101."—Act of August 26, 1912, appropriated \$250,000 for light vessels for general service. Plans and specifications were prepared for a second-class vessel for general relief duty on the Atlantic coast, to be assigned to the light-vessel station off Cape Charles, Va., and on March 6, 1915, a contract was awarded for its construction to the Pusey & Jones Co., of Wilmington, Del., in the sum of \$93,699. The vessel was launched January 12, 1916, and was completed and placed on station October 4, 1916.

Light vessel "No. 102" (Southwest Pass).—The act of October 22, 1913, appropriated \$125,000 for a light vessel for the Southwest Pass entrance to the Mississippi River, La. Plans and specifications for a vessel generally similar to *No. 101* were prepared, and on March 6, 1915, a contract was awarded for its construction to the Pusey & Jones Co., of Wilmington, Del., in the sum of \$93,699. The vessel was launched November 27, 1915, and was completed and placed on station February 24, 1917.

Light vessels "No. 103" and "No. 104."—The act of June 12, 1917, appropriated \$150,000 for light vessels for general lake service. Plans and specifications for two vessels similar in construction to light vessel *No. 99* are now in preparation. No expenditures were made to June 30, 1917.

Light vessel "No. 105" (Cape Charles).—The act of June 12, 1917, appropriated \$130,000 for a light vessel for Cape Charles, Va. A preliminary design has been started. No expenditures were made to June 30, 1917.

SPECIAL WORKS OF CONSTRUCTION COMPLETED (OMITTING VESSELS).

Oil houses for light stations.—The acts of May 27, 1908, March 4, 1909, and June 25, 1910, each appropriated \$10,000 for establishing isolated oil houses for the storage of kerosene, etc. During the fiscal year oil houses were completed at Point Judith, N. Y., for \$521.48, and at Carysfort Reef, Fla., for \$188.

THIRD DISTRICT.

Staten Island Lighthouse Depot, N. Y.—The act of August 1, 1914, appropriated \$23,000 for the erection of a new carpenter shop at the general lighthouse depot, Tompkinsville, N. Y. The work was started in August, 1915, and completed in January, 1916. The structure is a three-story reinforced-concrete building 121 feet by 60 feet. Amount expended to June 30, 1917, \$21,855.49.

SIXTH DISTRICT.

Depot for the sixth lighthouse district.—The act of October 22, 1913, appropriated \$125,000 for the purchase of a site and the construction of a wharf and buildings for a depot in the sixth lighthouse district. A creosoted-timber wharf and an untreated-timber bulkhead have been constructed. Obsolete buildings have been removed and deposited as riprap around the outside of the bulkhead. The depot site has been filled by hydraulic dredging and fenced in. One of the buildings purchased with the site has been remodeled and since August 1, 1916, has been occupied as the depot storehouse. Amount expended to June 30, 1917, \$125,000.

SEVENTH DISTRICT.

Dry Tortugas Light Station, Fla.—The act of September 8, 1916, appropriated \$125,000 for repairing and rebuilding aids to navigation, Gulf of Mexico, from which an allotment of \$2,800 was made for this station. During the year a wrought-iron pile wharf with cast-iron caps and wooden girders, stringers, and decking was erected in place of the old wharf, which was destroyed. All work was completed in May, 1917. Amount expended to June 30, 1917, \$2,631.19.

TWELFTH DISTRICT.

Manistique, Mich.—The act of October 27, 1913, appropriated \$20,000 for aids to navigation, Manistique, Mich. Site was purchased, and a duplex dwelling for two keepers was built. A fixed white post lantern on the west pierhead and a steel tower on a concrete base on the west breakwater, showing an acetylene light, were placed in commission October 30, 1914. A steel tower was erected on a concrete base on the east breakwater and provided with an electric incandescent lamp and a diaphone fog signal, which went into commission August 17, 1916. Amount expended to June 30, 1917, \$19,977.70.

SIXTEENTH DISTRICT.

Cape St. Elias Light and Fog Signal Station, Alaska.—The act of October 22, 1913, appropriated \$115,000 for the construction of a light and fog-signal station at Cape St. Elias, Alaska. A site was selected on the south end of Kayak Island, and construction begun June 1, 1915. Operations were suspended October 7, 1915, for the winter and resumed April 17, 1916. Construction work was suspended October 1, 1916, the station being practically completed. The light was placed in commission September 6, 1916, and the fog signal on January 30, 1917. A radio station was in operation from May 10 to November 9, 1916, to facilitate supervision and expedite construction. A small party, operating in June, 1917, removed construction buildings, cleared premises, etc., and completed station on June 30. Amount expended to June 30, 1917, \$113,545.10.

SPECIAL WORKS OF CONSTRUCTION UNCOMPLETED (OMITTING VESSELS).

FIRST DISTRICT.

Dog Island, Eastport, Me.—An appropriation of \$3,500 was made by the act of July 1, 1916, for placing an unattended light on Dog Island, Eastport, Me. Immediate steps were taken to procure title to the site, and after considerable delay the matter was placed in the hands of the proper United States district attorney for condemnation proceedings. The date of completion is indefinite. No expenditures were made to June 30, 1917.

SECOND DISTRICT.

Cape Cod Canal Lights, Mass.—The act of August 1, 1914, appropriated \$50,000 for lighting approaches to Cape Cod Canal, Mass. At the eastern entrance, Sandwich, Cape Cod Bay, 1 acetylene high-power gas and bell buoy, 1 Pintsch-gas and bell buoy, 1 spar buoy, 1 electric-lighted lens lantern on iron tower on breakwater, and at the western entrance, Buzzards Bay, 3 acetylene-gas and bell buoys, 3 acetylene-gas buoys, 14 acetylene-lighted beacons, 1 first-class can, 1 first-class nun, and 6 spar buoys were established. Upon completion of breakwater at eastern entrance the light will be moved to the end of the same and electrically operated fog bell installed. The candlepower of Wings Neck Light was increased from 180 to 2,900 by installation of oil-vapor apparatus. Internal-combustion engines and compressors have been purchased, and a reed horn will be installed at Wings Neck in place of bell operated by clockwork, about September 1, 1917, completing operations under this appropriation. Amount expended to June 30, 1917, \$47,721.06.

Woods Hole, Mass., Lighthouse Depot.—The act of July 1, 1916, appropriated \$50,000 for improvements at Woods Hole (Mass.) depot. The channel leading to the depot, about 3,200 feet long, was dredged to a depth of 17 feet and width of 150 feet; the basin, about 550 feet by 400 feet, was dredged to the same depth, at a cost of \$33,171.79.

Contract has been let in the sum of \$15,377.19, and work is about 35 per cent completed, on construction of a new brick storehouse, 35 feet by 80 feet, two stories high. Amount expended to June 30, 1917, \$33,171.69.

THIRD DISTRICT.

Hunts Point, N. Y.—The act of March 4, 1911, appropriated \$5,000 for establishment of a light and fog signal to mark Hunts Point, between Hell Gate and White-stone Point, East River, N. Y. The work of erecting a structure for the light and fog signal was started in November, 1916, and the light went into commission January 4, 1917. The structure consists of a steel tower built on a stone and concrete foundation, with the necessary provision made for the establishment of a fog signal later when it is practicable to procure electric current for its operation. The date of completion of this project is indefinite. Amount expended to June 30, 1917, was \$3,520.21.

Aids to navigation, Hudson River, N. Y.—The act of July 1, 1916, appropriated \$100,000 for improving the aids to navigation and establishing new aids on the Hudson River, N. Y. The work of improving, rebuilding, and establishing will affect 24 different lights. The work in progress consists in building and equipping barge for the purpose, building four steel towers, and action started to purchase necessary land for sites for new lights. The work was started in December, 1916, and it is expected will be completed about October, 1918. The total amount expended to June 30, 1917, was \$40.66.

Staten Island Lighthouse Depot, N. Y.—The act of June 12, 1917, appropriated \$21,000 for improving the offices and laboratory at the general lighthouse depot,

Tompkinsville, N. Y. No work has as yet been done or expenditures made under this appropriation.

Aids to navigation, East River, N. Y.—The act of June 12, 1917, appropriated \$16,000 for improving the aids to navigation on the East River, N. Y., consisting of improvements and changes in system of lights and the establishment of an additional light. No work has as yet been done or expenditures made under this appropriation.

Great Salt Pond Light Station, R. I.—The act of June 12, 1917, appropriated \$20,000 for building new dwelling and moving the fog signal from the inner to the outer end of the breakwater. No work has as yet been done or expenditures made under this appropriation.

FOURTH DISTRICT.

Joe Flogger Shoal, Del.—The act of June 20, 1906, authorized \$75,000 for establishing a light and fog signal at or near this shoal. The act of June 30, 1906, appropriated \$40,000 for this purpose, and the act of June 17, 1910, increased the limit of cost for this light and fog signal to \$105,000. An additional appropriation has not yet been made. Work on this project has been deferred, as the total amount necessary has not been appropriated and other projects are considered of greater importance. The shoal is now marked by two gas buoys. Amount expended to June 30, 1917, \$603.21.

Delaware River, Pa. and Del., aids to navigation.—The act of March 3, 1915, authorized this work. The act of July 1, 1916, appropriated \$80,000 for the purpose. Under this appropriation the following work was performed or under way at the close of the fiscal year. Design and specifications approved for erecting two ranges to mark the new 35-foot channel as follows:

Chester Range Front: Contract awarded; some piles were driven; and riprap deposited for the foundation of the crib.

Chester Range Rear: Contract awarded; foundation piles driven; grillage installed; and concrete piers for tower built.

Marcus Hook Range Front: Contract awarded; materials being collected; and erection will begin in July.

Marcus Hook Range Rear: Design of tower and dwelling completed. A site is being acquired by condemnation proceedings. As soon as it is acquired bids will be invited to erect the tower, etc.

Under this appropriation the bell for Fort Mifflin fog signal was replaced by an electric siren.

It is expected that all work under the appropriation will be completed during 1918. Amount expended to June 30, 1917, \$14,599.06.

FIFTH DISTRICT.

Aids to navigation, Cape Charles City, Va.—The act of June 12, 1917, appropriated \$12,800 for improving lights and fog signals leading to Cape Charles City, Va. As this appropriation has just been made, nothing definite has been done except to give some preliminary consideration to plans for the main structure to replace Cherry-stone Light Station.

Aids to navigation, Chesapeake Bay, Md. and Va.—The act of June 12, 1917, appropriated \$29,000 for aids to navigation on the eastern shore of the Chesapeake Bay and tributaries. As this appropriation has just been made, only preliminary consideration has been given to location of some of the aids to be established.

SIXTH DISTRICT.

St. Johns River, Fla.—The act of July 1, 1916, appropriated \$66,000 for improving aids to navigation and establishing new aids on the St. Johns River, Fla. Range lens lantern and other illuminating apparatus to the amount of \$4,540, have been purchased and delivered. Six 30-foot rear-range pipe towers and 11 8-foot front-range pipe towers were contracted for and delivered on March 7, 1917. Preparations have been made to construct Wilson Channel Beacons Nos. 1, 3, and 5. A contract to construct one 60-foot pipe tower for Steep Bank Range Rear Light was made April 23, 1917, for the sum of \$1,036.20.

Requisition for 3 type L gas buoys, 3 first-class nuns, 2 first-class cans, and 3 second-class cans has been made, and partial delivery completed. Amount expended to June 30, 1917, \$12,406.50.

SEVENTH DISTRICT.

Florida Reefs, Fla.—The act of July 1, 1916, appropriated \$75,000 for establishing additional lighted aids and repairing and improving existing aids. Under this appropriation part of the illuminating apparatus was ordered, a portion of which has

been delivered. Plans and specifications for metal work and glass, complete, for two 45-foot light towers, one for Molasses Reef and the other for Pacific Reef, were approved during the year, and advertisement for bids for same, to be opened July 31, 1917, has been issued. The date of completion is indefinite. Amount expended to June 30, 1917, \$1,127.

EIGHTH DISTRICT.

Aids to navigation, Mississippi River, La.—The act of July 1, 1916, appropriated \$50,000 for the improvement of aids to navigation on the Mississippi River below New Orleans. During the fiscal year a contract, in the sum of \$18,087.50, was awarded to the Union Steel Products Co., of Albion, Mich., for furnishing 25 structural-steel towers. No further progress can be made until these towers are received. Amount expended to June 30, 1917, \$567.57.

Aids to navigation, Atchafalaya Entrance Channel, La.—The act of October 22, 1913, appropriated \$50,000 for establishing aids to navigation in Atchafalaya Entrance Channel, La. During the preceding fiscal year, which ended June 30, 1916, Point au Fer Reef Lighthouse and Atchafalaya Entrance Channel Lights Nos. 1, 3, 5, 7, 9, and 2 were completed. Requisition has been made for the necessary gas-lighted buoys, and an order has been placed with the United States naval station, New Orleans, La., for the construction of a 42-foot motor launch. The buoys have not yet been received and the launch has not been completed. Amount expended to June 30, 1917, \$32,708.59.

Galveston Jetty Light Station, Tex.—The act of June 11, 1896, appropriated \$35,000 and the act of May 27, 1908, \$10,000 for establishing a light and fog-signal station at or near the outer end of one of the jetties at Galveston Harbor, Tex. Great damage was done the uncompleted structure by the hurricane of August 16-17, 1915, which destroyed the construction wharf, bent the framework of the structure, and washed away much material. Subsequently materials were again assembled, another construction wharf erected, and the framework straightened. The construction wharf was again washed away in the hurricane of August 18, 1916, and some of the lower struts of the substructure were again bent. A portion of the lens for this station was lost in the hurricane of July 5-6, 1916, one box containing parts of same having been washed away from the Mobile Lighthouse Depot. It was ordered replaced from the third district. Intermediate beams to reinforce struts of lower and middle sections were ordered. In March, 1917, the construction wharf was rebuilt for the third time. At the end of May, 1917, the installation of intermediate beams to reinforce struts was completed and the building of a concrete block 49-feet square and in places 10 to 15 feet in depth on northerly and southerly edges was commenced. Amount expended to June 30, 1917, \$44,460.60.

Repairing and rebuilding aids to navigation, Gulf of Mexico.—The act of February 28, 1916, appropriated \$200,000 for repairing and rebuilding aids to navigation damaged or destroyed by hurricanes on the Gulf of Mexico. There is given below a list of the work that has been completed and that is in progress, in addition to which there is certain work that has not yet been reached, every effort having been made to restore aids to navigation before less important work was commenced. During the fiscal year the following portions of the work have been completed:

Bayou Dupre Light, La.: Pyramidal structure on four iron-cased creosoted piles, showing oil lens-lantern light, rebuilt.

Biloxi Harbor Lights, Miss.: Repaired and rebuilt 850 feet of wharf, boathouse, etc.

Boats: Five 20-foot power dories and three 16-foot and three 14-foot yawls were built.

Bolivar Roads Day Beacon, Tex.: Pyramidal structure on nine iron-cased creosoted piles rebuilt.

Brazos River Light Station, Tex.: Rebuilt T wharf, walks, storehouse, outhouses, stairways, fences, etc.

Double Bayou Lights Nos. 2 and 4, Tex.: Rebuilt pyramidal superstructure and general repairs.

East Bank Light, Tex.: Pyramidal structure on four iron-cased creosoted piles, showing flashing acetylene light, rebuilt.

Galveston North Jetty Light, Tex.: Increased the height of four iron-pipe piles filled with reinforced concrete, which are embedded in a concrete block; installed tie-rods; rebuilt superstructure; and installed 375-millimeter flashing acetylene light.

Gulfport Channel Lights Nos. 2, 4, and 10, Miss.: Three pyramidal structures, each on nine iron-cased creosoted piles, showing oil lens-lantern lights, rebuilt.

Hitchcock Reef Light, Tex.: Pyramidal structure on four iron-cased creosoted piles, showing flashing acetylene light, rebuilt.

Houston Channel Range Lights, Tex.: Two pyramidal structures, each on nine iron-cased creosoted piles, showing fixed acetylene lights, rebuilt.

Houston Channel Lights Nos. 1, 3, and 3A, Tex.: Three pyramidal structures, each on nine iron-cased creosoted piles, showing flashing acetylene lights, rebuilt.

Houston Channel Lights Nos. 2 and 2A, Tex.: Two pyramidal structures, each on four iron-cased creosoted piles, showing flashing acetylene lights, rebuilt.

Long Point Light, La.: Pyramidal structure on four iron-cased creosoted piles, showing oil lens-lantern light, rebuilt.

New Canal Light Station, La.: Built 400 feet of interlocking creosoted sheet-pile bulkhead and placed reinforced-concrete foundation pillars under storehouse.

Pass Manchac East Channel Light, La.: Pyramidal structure on four iron-cased creosoted piles, showing oil lens-lantern light, rebuilt.

Pearl River Light and Beacon B, La.: Pyramidal structure on four iron-cased creosoted piles, showing oil lens-lantern light, rebuilt; also single iron-cased creosoted pile day beacon.

Port Arthur Canal Light, Tex.: Flashing acetylene light installed on this structure.

Port Bolivar Range Rear Light, Tex.: Pyramidal structure on nine iron-cased creosoted piles, showing oil lens-lantern light, rebuilt.

Sabine Pass East Jetty Light, La.: Built structure consisting of four iron-pipe piles filled with reinforced concrete, embedded in concrete block, braced with tie-rods, supporting pyramidal superstructure, showing 375-millimeter flashing acetylene light.

Sabine Pass Channel Light, La.: Pyramidal structure on nine iron-cased creosoted piles, showing flashing acetylene light.

Sabine Pass Entrance Range and Sabine Pass Inner Range Lights, La.: Four pyramidal structures, each on nine iron-cased creosoted piles, showing oil lens-lantern lights, rebuilt.

Sabine Pass Light Station, La.: Built a 100-foot T-head wharf, 1,500 feet of walk, using creosoted piles and stringers and untreated decking and joists; also new boat-house on six iron-cased creosoted piles.

St. Joseph Island Beacon, La.: Pyramidal structure on four iron-cased creosoted piles rebuilt.

Seabrook, Light, Tex.: Pyramidal superstructure rebuilt and flashing acetylene light installed.

Second Turn Light, Tex.: Pyramidal structure on nine iron-cased creosote piles, showing flashing acetylene light, rebuilt.

Southwest Pass Range Rear Light Station, La.: Built 1,420 feet of walks with T-head, using creosoted piles and stringers and untreated decking.

Tangipahoa River Light, La.: Pyramidal superstructure rebuilt and oil lens-lantern light installed.

Timbalier Lighthouse, La.: Built a new frame structure surmounted by tower and lantern, supported on 25 iron-cased creosoted piles, and established bell for fog signal struck by machinery.

Trinity River Lights A and B, Tex.: Two pyramidal structures, each on four iron-cased creosoted piles, showing oil lens-lantern lights, rebuilt.

West Rigolets Light, La.: Raised this lighthouse 6 feet, and built reinforced-concrete column foundation; repaired outbuildings, walks, wharf, and bulkhead.

The following work is in progress at the end of the fiscal year:

Bolivar Point Light Station, Tex.: Building two frame dwellings supported on high iron columns which rest on pile foundations, oil house, outhouses, and fences.

Chefuncte River Light Station, La.: Materials have been assembled to rebuild breakwater and repair wharf.

Lake Borgne Light Station, Miss.: Materials have been assembled to rebuild boat-house, wharf, walks, steps, platform, etc.

Pointe Aux Herbes Light Station, La.: Rebuilding 510 feet of breakwater with cypress piles and sheet piling.

Sabine Bank Light Station, Tex.: Contract was entered into for furnishing cast-iron work with which to close in veranda floor of lighthouse, renew railings, new davits, and other repairs. The ironwork has not been received at the end of the fiscal year. Amount expended to June 30, 1917, \$113,176.06.

The act of September 8, 1916, appropriated \$125,000 for repairing and rebuilding aids to navigation damaged or destroyed by hurricanes on the Gulf of Mexico, of which \$122,200 was allotted for this district. There is given below a list of the work that has been completed and that is in progress, in addition to which there is certain work that has not yet been reached, and every effort is being made to rebuild aids to navigation before less important work is commenced. During the fiscal year the following work has been completed.

Boat: One 14-foot centerboard yawl was built.

Pass aux Herons Lights Nos. 2, 4, 6, and 8 and Beacon 2, Ala.: Four pyramidal structures, each on four iron-cased creosoted piles, showing oil lens-lantern lights, rebuilt and one single iron-cased creosoted-pile day beacon.

The following work is in progress at the end of the fiscal year, a portion of it being completed:

Mobile Channel Lights, Ala.: Thirteen structures are being rebuilt, each on nine iron-cased creosoted piles, supporting house surmounted by pyramid, from which light is shown, and one single iron-cased creosoted-pile day beacon. Eight structures which were not destroyed in the hurricane are being repaired. Six lights have been completed, and the foundations have been driven for all new lights.

Mobile Point Beacon Light, Ala.: Rebuilding as a pyramidal structure on square creosoted foundation resting on creosoted mudsills supported by creosoted piles.

Sand Island Light Station, Ala.: Contract was entered into during the fiscal year for furnishing and placing in position around light tower 2,700 tons of rock, ranging in weight from 1 to 4 tons each piece. The contractor had at the end of the fiscal year landed at the station about 1,400 tons of rock and was placing same in the proper locations as directed. Eight iron-cased creosoted piles have been driven for a new boathouse at this station.

Materials have been assembled with which to rebuild eight lights, in addition to those mentioned above, each to consist of iron-cased creosoted piles supporting pyramidal superstructure. Amount expended to June 30, 1917, \$33,024.24.

Sabine Jetty Light Station, La.—The act of May 27, 1908, appropriated \$40,000 for a light and fog signal at or near the end of Sabine Pass Jetty. Nothing has been done on the work, in view of the proposed project of the War Department to extend the jetties to the 25-foot contour, a distance of possibly 2 miles. At the close of the fiscal year 1917 no money had been expended or obligated.

NINTH DISTRICT.

Navassa Island Light Station, West Indies.—The act of October 22, 1913, appropriated \$125,000 for the erection of a light station on this island. Surveys were made and preliminary plans submitted, which were worked up into final designs in the Bureau's office. The work was advertised in July, 1915, and bids opened September 30, 1915. Contracts were awarded on October 2, 1915, for the metal work and for the erection. The contractors for erecting assembled material, engaged a schooner, and commenced operations at the site in January, 1916. During the spring of 1916 the metal work was completed and shipped, and preparatory work of building camps and construction plant at the island completed. Excavation for the foundation was commenced in May, 1916, and concrete work started shortly after the close of the fiscal year. During the past year the work has progressed steadily, notwithstanding the difficulties presented by the remoteness of the site and the lack of local water supply. The tower, keepers' dwelling, landing facilities, installation of illuminating apparatus, etc., are practically completed, with some work remaining to be done on the railroad track. The light was placed in commission on October 21, 1917. It is expected that the entire project will be completed early in November, 1917. Amount expended to June 30, 1917, \$68,695.79.

TENTH DISTRICT.

Ashtabula Harbor, Ohio.—The act of October 22, 1913, appropriated \$45,000 for rearranging, rebuilding, and improvement of aids to navigation at Ashtabula Harbor, Ohio. Work has been in progress at the site throughout the year. New light placed in commission September 21, 1916, and new fog signal in commission March 26, 1917. It is expected to complete interior finish of structure during present season. Amount expended to June 30, 1917, \$41,313.45.

Cleveland Harbor, Ohio.—The act of October 22, 1913, appropriated \$17,600 for removal, reconstruction, and improvement of the fog-signal station at Cleveland Harbor, Ohio. Fog-signal plant installed and signal in commission August 18, 1916. It is expected to complete interior finish of structure during present season. Amount expended to June 30, 1917, \$17,310.97.

Lorain Harbor, Ohio.—The act of October 22, 1913, appropriated \$35,000 for a light and fog-signal station and improvement of aids to navigation at Lorain Harbor, Ohio. On June 30, 1917, the concrete structure had been erected, roof completed except shingling, metal work of lantern erected, and concrete forms removed. Temporary light in commission shown from new lantern. It is expected to install permanent light this season and place fog signal in commission early next season. Amount expended to June 30, 1917, \$31,546.13.

Conneaut Harbor, Ohio.—The act of July 1, 1916, appropriated \$63,500 for a light and fog signal and improving aids to navigation at Conneaut Harbor, Ohio. Preliminary plans for the structure have been approved. Contract for steel framework,

railings, and davits for foundation base has been awarded. The structure will probably be completed next season. Amount expended to June 30, 1917, \$704.43.

Toledo Harbor, Ohio.—The act of July 1, 1916, appropriated \$15,000 for improving the aids to navigation in Toledo Harbor, Ohio. Contract has been executed for furnishing two skeleton steel towers for Manhattan Range Lights, and it is expected to erect the towers during the present season. Amount expended to June 30, 1917, \$143.00.

Fairport Harbor, Ohio.—The act of June 12, 1917, appropriated \$42,000 for improving aids to navigation at Fairport Harbor, Ohio. No expenditures have been made from this appropriation.

Huron Harbor, Ohio.—The act of June 12, 1917, appropriated \$4,500 for establishing aids to navigation at Huron Harbor, Ohio. No expenditures have been made from this appropriation.

ELEVENTH DISTRICT.

Detroit River, Mich.—The act of March 4, 1911, appropriated \$210,000 for establishing aids to navigation along the Livingstone Channel, Detroit River, Mich., including authority to locate and construct lights and to place buoys necessary to properly mark this channel. On June 30, 1917, 12 concrete piers had been completed and 9 beacons lights placed in commission. The other 3 await completion of contemplated changes in the channel before they can be utilized. Thirteen gas buoys and 21 spar buoys are now used to mark the channel, in addition to the lights on piers. Plans have been prepared for the construction of a light and fog signal near the southern end of the channel, which, if carried out, will relieve a lightship now maintained in the locality and which is becoming badly deteriorated, requiring early condemnation. Two additional piers lights will be established, taking the place of gas buoys now maintained on the west side. This can not be done until the proposed channel widening has been completed. In addition to the lights along the channel proper, a semaphore system for controlling the movements of vessels through the channel has been constructed and placed in operation. After one season's operation the continuance of this system was found justified, and steps are now being taken to relocate the semaphore stations in more favorable locations and provide a permanent foundation and structure for the north one. It is expected that the changes in location will be made effective about September 30, 1917. Amount expended to June 30, 1917, \$145,133.99.

Aids to navigation, Fighting Island Channel, Detroit River, Mich.—The act of July 1, 1916, appropriated \$25,000 for aids to navigation, Fighting Island Channel, Detroit River, Mich. Under this appropriation, a nonattended flashing acetylene light, known as Fighting Island South, has been established off the south end of the island on a skeleton steel tower to mark the junction of the Fighting Island and Ballards Reef Channel. Six type S acetylene-gas buoys have been contracted for to mark points along the channel banks, and the construction of a permanent pier light to mark the upper end of the channel on the east side has been started. Fighting Island South Light was placed in commission November 1, 1916, and Pintsch-gas buoys were temporarily established at the opening of navigation this season to mark the locations selected for the permanent acetylene-gas buoys. Three ranges along the channel not adapted to use in the new channel have been discontinued, one light being retained as a side light in each case. It is expected that all work under this appropriation will be completed within the fiscal year 1918. Amount expended to June 30, 1917, \$8,399.25.

Sand Hills Light Station, Mich.—The act of June 12, 1917, appropriated \$70,000 for the establishment of a light station and fog signal at or near Sand Hills. The site has been selected and a survey made, also preliminary steps toward purchase have been taken. General plans for the principal structure have been prepared and approved. Detail plans will be prepared and the work commenced this season. Work done this season will probably be limited to clearing, preparation of foundation, construction of workmen's quarters, etc. It is expected that the station will be completed and placed in operation during the season of 1918. No expenditures have been made from this appropriation.

Aids to navigation, Keweenaw Waterway, Mich.—The act of June 12, 1917, appropriated \$105,000 for aids to navigation, Keweenaw Waterway, Mich. An examination of the site for the fog-signal and light structure proposed to mark the south entrance to Keweenaw Waterway has been made and a test pile driven to determine bearing power. Plans for the proposed structures are now in the course of preparation. It is expected that the station will be completed and placed in operation during the season of 1918. The construction of a derrick scow to facilitate the work of erection has been commenced. No expenditures have been made from this appropriation.

TWELFTH DISTRICT.

White Shoal, Mich.—The act of March 4, 1907, appropriated \$250,000 for a light and fog-signal station at White Shoal, north end of Lake Michigan, to replace the White Shoal Light Vessel. Tower was completed and light placed in commission September 1, 1910; fog signal placed in commission September 15, 1910; submarine bell established September 20, 1911; water-supply system installed October, 1911; oil-storage system installed June, 1913; auxiliary flashing winter light established December, 1914. Equipment of three boat cranes with air-driven hoists under way. Amount expended to June 30, 1917, \$225,181.57.

Chicago Harbor, Ill.—The act of June 12, 1917, appropriated \$88,000 for the removal of Chicago Harbor light and fog signal from its present location to the south end of the north arm of the extension of the exterior breakwater and rebuilding the station. Skeleton steel towers are to be erected on both the north and the south ends of the south-arm extension and are to be equipped with acetylene lights. Plans for the rebuilding of the main light and the foundations and towers for the south arm are being prepared. No expenditures have been made from this appropriation.

Indiana Harbor, Ind.—The act of June 12, 1917, appropriated \$100,000 for the establishment and improvement of aids to navigation at Indiana Harbor, Ind. Lighthouse tower and fog signal to be erected at the east end of the north arm of the breakwater. A skeleton steel tower is to be erected on the north end of the south arm on a concrete base and acetylene light installed. No expenditures have been made from this appropriation.

Manitowoc Breakwater, Wis.—The act of June 12, 1917, appropriated \$21,000 for improving the light and fog-signal station at Manitowoc, Wis. New steel fog-signal and light station to be erected; improved light to be established; first-class air siren and compressors to be installed. No expenditures have been made from this appropriation.

SIXTEENTH DISTRICT.

Aids to navigation, Alaska.—The acts of August 1, 1914, and June 12, 1917, each appropriated \$60,000 for establishing and improving aids to navigation in Alaskan waters. During the year 2 acetylene lights and 6 gas buoys were established from the above appropriation. Order has been placed for the illuminating apparatus required for 14 additional acetylene lights, and these aids will be established as soon as practicable. On June 30, 1917, the total expenditure from the appropriation of August 1, 1914, was \$58,628.33. No expenditures were made from the appropriation of June 12, 1917, up to June 30, 1917.

SEVENTEENTH DISTRICT.

Aids to navigation, Puget Sound, Wash.—The act of October 22, 1913, appropriated \$30,000 for aids to navigation and improvements in existing aids in Puget Sound and adjacent waters, Washington. Under this appropriation the following work was performed:

West Point Light Station: Three-way horns were installed, and the fog-signal engines and compressors were given a general overhauling, at a cost of \$192.14.

Point Wilson Light Station: A double-mouth horn was installed on siren, at a cost of \$32.

Cape Flattery Light Station: Improvements to fog signal. A diaphone was purchased, at a cost of \$1,320.

Slip Point Light Station: New illuminating apparatus, consisting of a fourth-order bivalve lens with fourth-order vapor lamp, characteristic of light a white flash of 80,000 candlepower every 5 seconds, was installed in place of the former lens lantern, and a new fog-signal plant, consisting of a diaphone and 12-horsepower internal-combustion engines, was established, at a total cost of \$9,204.58.

Lake Washington Canal electric incandescent post lights: Two sets of duplex occulting apparatus, with double lens-lantern lenses, were purchased and turned over to the United States engineers for installation and operation. Cost, \$260.86.

Pully Point electric incandescent post light: The characteristic of this light was changed, and its intensity increased by changing from oil to electricity, at a cost of \$1,043.40.

Apple Cove Point Light: Expended on this project to date, \$1,034.12.

Marrowstone Point Light Station: Change in light and fog signal and erection of new fog-signal building. Cost, \$713.70.

Total amount expended from this appropriation to June 30, 1917, \$25,945.47.

Kellett Bluff Light Station, Wash.—The sundry civil act approved July 1, 1916, appropriated \$40,000 for establishing a light and fog-signal station at or near Kellett Bluff, Henry Island, Wash., or at some point on the west coast of San Juan Island, Wash.

The Compensation Schedule is subject to review and modification by the Board of Directors at any time. The Compensation Committee will review the Compensation Schedule annually and recommend any changes to the Board of Directors.

The Compensation Committee will also review the Compensation Schedule for compliance with applicable laws and regulations. The Compensation Committee will also review the Compensation Schedule for consistency with the Company's long-term goals and objectives.

COMPENSATION SCHEDULE

The Compensation Schedule is subject to review and modification by the Board of Directors at any time. The Compensation Committee will review the Compensation Schedule annually and recommend any changes to the Board of Directors.

COMPENSATION SCHEDULE FOR 2023

Position	Base Salary	Target Bonus	Total Compensation
Chief Executive Officer	\$1,000,000	\$200,000	\$1,200,000
Chief Financial Officer	\$500,000	\$100,000	\$600,000
Chief Operating Officer	\$400,000	\$80,000	\$480,000
President, North America	\$300,000	\$60,000	\$360,000
President, Europe	\$250,000	\$50,000	\$300,000
President, Asia	\$200,000	\$40,000	\$240,000
President, Latin America	\$150,000	\$30,000	\$180,000
President, Middle East	\$100,000	\$20,000	\$120,000
President, Africa	\$80,000	\$16,000	\$96,000
President, Australia	\$70,000	\$14,000	\$84,000
President, New Zealand	\$60,000	\$12,000	\$72,000
President, South Africa	\$50,000	\$10,000	\$60,000
President, India	\$40,000	\$8,000	\$48,000
President, China	\$30,000	\$6,000	\$36,000
President, Japan	\$20,000	\$4,000	\$24,000
President, Korea	\$15,000	\$3,000	\$18,000
President, Taiwan	\$10,000	\$2,000	\$12,000
President, Hong Kong	\$8,000	\$1,600	\$9,600
President, Singapore	\$6,000	\$1,200	\$7,200
President, Malaysia	\$5,000	\$1,000	\$6,000
President, Thailand	\$4,000	\$800	\$4,800
President, Philippines	\$3,000	\$600	\$3,600
President, Indonesia	\$2,000	\$400	\$2,400
President, Vietnam	\$1,500	\$300	\$1,800
President, Cambodia	\$1,000	\$200	\$1,200
President, Laos	\$800	\$160	\$960
President, Myanmar	\$600	\$120	\$720
President, Brunei	\$500	\$100	\$600
President, Timor-Leste	\$400	\$80	\$480
President, East Timor	\$300	\$60	\$360
President, West Bank	\$200	\$40	\$240
President, Gaza	\$150	\$30	\$180
President, Jordan	\$100	\$20	\$120
President, Iraq	\$80	\$16	\$96
President, Kuwait	\$60	\$12	\$72
President, Saudi Arabia	\$50	\$10	\$60
President, United Arab Emirates	\$40	\$8	\$48
President, Qatar	\$30	\$6	\$36
President, Oman	\$20	\$4	\$24
President, Bahrain	\$15	\$3	\$18
President, Kuwait	\$10	\$2	\$12
President, Saudi Arabia	\$8	\$1.6	\$9.6
President, United Arab Emirates	\$6	\$1.2	\$7.2
President, Qatar	\$5	\$1	\$6
President, Oman	\$4	\$0.8	\$4.8
President, Bahrain	\$3	\$0.6	\$3.6
President, Kuwait	\$2	\$0.4	\$2.4
President, Saudi Arabia	\$1.5	\$0.3	\$1.8
President, United Arab Emirates	\$1	\$0.2	\$1.2
President, Qatar	\$0.8	\$0.16	\$0.96
President, Oman	\$0.6	\$0.12	\$0.72
President, Bahrain	\$0.5	\$0.1	\$0.6
President, Kuwait	\$0.4	\$0.08	\$0.48
President, Saudi Arabia	\$0.3	\$0.06	\$0.36
President, United Arab Emirates	\$0.2	\$0.04	\$0.24
President, Qatar	\$0.15	\$0.03	\$0.18
President, Oman	\$0.1	\$0.02	\$0.12
President, Bahrain	\$0.08	\$0.016	\$0.096
President, Kuwait	\$0.06	\$0.012	\$0.072
President, Saudi Arabia	\$0.05	\$0.01	\$0.06
President, United Arab Emirates	\$0.04	\$0.008	\$0.048
President, Qatar	\$0.03	\$0.006	\$0.036
President, Oman	\$0.02	\$0.004	\$0.024
President, Bahrain	\$0.015	\$0.003	\$0.018
President, Kuwait	\$0.01	\$0.002	\$0.012
President, Saudi Arabia	\$0.008	\$0.0016	\$0.0096
President, United Arab Emirates	\$0.006	\$0.0012	\$0.0072
President, Qatar	\$0.005	\$0.001	\$0.006
President, Oman	\$0.004	\$0.0008	\$0.0048
President, Bahrain	\$0.003	\$0.0006	\$0.0036
President, Kuwait	\$0.002	\$0.0004	\$0.0024
President, Saudi Arabia	\$0.0015	\$0.0003	\$0.0018
President, United Arab Emirates	\$0.001	\$0.0002	\$0.0012
President, Qatar	\$0.0008	\$0.00016	\$0.00096
President, Oman	\$0.0006	\$0.00012	\$0.00072
President, Bahrain	\$0.0005	\$0.0001	\$0.0006
President, Kuwait	\$0.0004	\$0.00008	\$0.00048
President, Saudi Arabia	\$0.0003	\$0.00006	\$0.00036
President, United Arab Emirates	\$0.0002	\$0.00004	\$0.00024
President, Qatar	\$0.00015	\$0.00003	\$0.00018
President, Oman	\$0.0001	\$0.00002	\$0.00012
President, Bahrain	\$0.00008	\$0.000016	\$0.000096
President, Kuwait	\$0.00006	\$0.000012	\$0.000072
President, Saudi Arabia	\$0.00005	\$0.00001	\$0.00006
President, United Arab Emirates	\$0.00004	\$0.000008	\$0.000048
President, Qatar	\$0.00003	\$0.000006	\$0.000036
President, Oman	\$0.00002	\$0.000004	\$0.000024
President, Bahrain	\$0.000015	\$0.000003	\$0.000018
President, Kuwait	\$0.00001	\$0.000002	\$0.000012
President, Saudi Arabia	\$0.000008	\$0.0000016	\$0.0000096
President, United Arab Emirates	\$0.000006	\$0.0000012	\$0.0000072
President, Qatar	\$0.000005	\$0.000001	\$0.000006
President, Oman	\$0.000004	\$0.0000008	\$0.0000048
President, Bahrain	\$0.000003	\$0.0000006	\$0.0000036
President, Kuwait	\$0.000002	\$0.0000004	\$0.0000024
President, Saudi Arabia	\$0.0000015	\$0.0000003	\$0.0000018
President, United Arab Emirates	\$0.000001	\$0.0000002	\$0.0000012
President, Qatar	\$0.0000008	\$0.00000016	\$0.00000096
President, Oman	\$0.0000006	\$0.00000012	\$0.00000072
President, Bahrain	\$0.0000005	\$0.0000001	\$0.0000006
President, Kuwait	\$0.0000004	\$0.00000008	\$0.00000048
President, Saudi Arabia	\$0.0000003	\$0.00000006	\$0.00000036
President, United Arab Emirates	\$0.0000002	\$0.00000004	\$0.00000024
President, Qatar	\$0.00000015	\$0.00000003	\$0.00000018
President, Oman	\$0.0000001	\$0.00000002	\$0.00000012
President, Bahrain	\$0.00000008	\$0.000000016	\$0.000000096
President, Kuwait	\$0.00000006	\$0.000000012	\$0.000000072
President, Saudi Arabia	\$0.00000005	\$0.00000001	\$0.00000006
President, United Arab Emirates	\$0.00000004	\$0.000000008	\$0.000000048
President, Qatar	\$0.00000003	\$0.000000006	\$0.000000036
President, Oman	\$0.00000002	\$0.000000004	\$0.000000024
President, Bahrain	\$0.000000015	\$0.000000003	\$0.000000018
President, Kuwait	\$0.00000001	\$0.000000002	\$0.000000012
President, Saudi Arabia	\$0.000000008	\$0.0000000016	\$0.0000000096
President, United Arab Emirates	\$0.000000006	\$0.0000000012	\$0.0000000072
President, Qatar	\$0.000000005	\$0.000000001	\$0.000000006
President, Oman	\$0.000000004	\$0.0000000008	\$0.0000000048
President, Bahrain	\$0.000000003	\$0.0000000006	\$0.0000000036
President, Kuwait	\$0.000000002	\$0.0000000004	\$0.0000000024
President, Saudi Arabia	\$0.0000000015	\$0.0000000003	\$0.0000000018
President, United Arab Emirates	\$0.000000001	\$0.0000000002	\$0.0000000012
President, Qatar	\$0.0000000008	\$0.00000000016	\$0.00000000096
President, Oman	\$0.0000000006	\$0.00000000012	\$0.00000000072
President, Bahrain	\$0.0000000005	\$0.0000000001	\$0.0000000006
President, Kuwait	\$0.0000000004	\$0.00000000008	\$0.00000000048
President, Saudi Arabia	\$0.0000000003	\$0.00000000006	\$0.00000000036

UNEXPENDED BALANCES ON JUNE 30, 1917, FROM APPROPRIATIONS FOR SPECIAL WORKS—Continued.

District.	Title of appropriation.	Acts.	Balance.
11th	Sand Hills Light Station, Mich.....	June 12, 1917.....	\$70,000.00
	Aids to navigation, Keweenaw Waterway, Mich.....	do.....	105,000.00
12th	White Shoal Light Station, Lake Michigan.....	Mar. 4, 1907.....	24,818.43
	Chicago Harbor Light Station, Ill.....	June 12, 1917.....	88,000.00
	Manitowoc Breakwater Light Station, Wis.....	do.....	21,000.00
	Aids to navigation, Indiana Harbor, Ind.....	do.....	100,000.00
16th	Aids to navigation, Alaska.....	Aug. 1, 1914; June 12, 1917 ..	61,371.67
	Cape St. Elias Light Station, Alaska.....	Oct. 22, 1913.....	1,454.90
17th	Aids to navigation, Puget Sound, Wash.....	do.....	4,054.53
	Kellett Bluff Light Station, Wash.....	July 1, 1916.....	38,741.66
	Aids to navigation, Coquille River, Oreg.....	do.....	5,963.66
	Aids to navigation, Washington and Oregon.....	June 12, 1917.....	35,000.00
18th	Point Vincente Light Station, Cal.....	July 1, 1916.....	79,986.50
19th	Aids to navigation, Pearl Harbor, Hawaii.....	June 12, 1917.....	80,000.00

BALANCES OF SPECIAL APPROPRIATIONS CARRIED TO THE SURPLUS FUND ON JUNE 30, 1917.

The following-named balances of special appropriations under the Lighthouse Service remaining on the books of the Treasury Department and relating to works which had been completed and against which no obligations were known to exist were carried to the surplus fund on June 30, 1917:

Tender for fifteenth lighthouse district.....	\$276.72
Rondout Creek Light Station, N. Y.....	6,424.19
Fort McHenry Channel Range Lights, Md.....	295.19
Milwaukee Light Vessel, Wis.....	459.73
Aids to navigation, Manistique, Mich.....	.04

Total carried to surplus fund..... 7,455.87

SAVING OF LIFE AND PROPERTY BY VESSELS OR EMPLOYEES OF THE LIGHTHOUSE SERVICE DURING THE FISCAL YEAR 1917.

District.	Vessel or employee rendering service.	Vessel, etc., aided.	Nature of assistance.
1st.....	A. J. Clinch, keeper, Franklin Island Light Station, Me.	Motor boat; William Collamore, owner.	Towed disabled boat with occupant to shore.
	J. B. Thurston, keeper, Fort Point Light Station, Me.	Motor boat.....	Towed disabled boat, with 8 men on board, to safe anchorage.
	do.....	do.....	Towed disabled boat, with 1 man aboard, to safe anchorage.
	A. B. Hamor, assistant keeper, Egg Rock Light Station, Me.	Motor boat, Walter Rath in charge.	Towed disabled boat to Bar Harbor, Me.
	Tender Zizania.....		Rescued from drowning 2 men fallen overboard from Grand Trunk Wharf, Portland, Me.
	E. H. Pierce, keeper, Doubling Point Range Light Station, Me.		Rescued from drowning insane man who jumped from wharf at Bath, Me.
	Tender Zizania.....	Sloop.....	Rescued 2 men marooned on Pettis Rock, Kennebec River, Me., and transported them to Bath, Me.
	Tender Hibiscus.....	Schooner Mary A. Hall, Capt. George Olsen.	Towed lumber-laden schooner, in dangerous position, to anchorage in Portland Harbor, Me.
	W. P. Kent, keeper, Egg Rock Light Station, Me.	Motor boat.....	Towed disabled boat, with 2 fishermen aboard, to station.
	A. C. Holt, keeper, Deer Island Thorofare Light Station, Me.	Schooner Sarah and Lucy, Capt. Perry; steamer Minnehaha.	Assisted in floating schooner, ashore on rocks off Andrews Island, Me., also assisted in towing disabled steamer Minnehaha to place of safety.
	J. E. Purington, keeper, Nash Island Light Station, Me.	Freighter B. B. W.; Jonesport Transportation Co.	Assisted in recovering freight and furnished crew with lodging and meals.
	A. C. Holt, keeper, Deer Island Thorofare Light Station, Me.	Motor boat; Everett Gross, owner.	Towed disabled boat to Stonington, Me.

SAVING OF LIFE AND PROPERTY BY VESSELS OR EMPLOYEES OF THE LIGHTHOUSE SERVICE DURING THE FISCAL YEAR 1917—Continued.

District.	Vessel or employee rendering service.	Vessel, etc., aided.	Nature of assistance.
1st.....	Portland Light Vessel No. 74, Me..	Motor boat; Charles Burgess, owner.	Furnished boat with batteries, etc.
	do.....	Motor boat; George McDonald, owner.	Hoisted boat and furnished wire and tools to tighten propeller.
2d.....	E. C. Mott, keeper, Deer Island Light Station, Mass.	Power boat Marion; Albert M o s e s, owner.	Towed disabled boat to safe anchorage, repaired engine, and furnished food and dry clothing to 3 occupants.
	Tender Azalea.....	Schooner yacht Hopewell, of Providence, R. I.	Pulled off stranded schooner and towed her to deep water.
	do.....	Knockabout Nellie, of Providence, R. I.	Towed disabled boat to Vineyard Haven, Mass.
	Nantucket Shoals Light Vessel No. 85, Mass.	Schooner Victor and Ethan; steamers Strathdene, West Point, and Christiana Knudson.	Furnished food and lodging to 115 shipwrecked men until arrival of United States destroyers.
	Stone Horse Shoal Light Vessel No. 5, Mass.	Fishing schooner Pontiac.	Furnished lodging to captain and 16 men of grounded vessel.
	T. Poole, laborer, Lovells Island Depot, Mass.		Rescued from drowning boy fallen off wharf.
	H. L. Thomas, keeper, Nantucket (Great Point) Light Station, Mass.	Schooner R o g e r Drury, of Boston, Mass.	Furnished food and dry clothing to captain and 5 men who abandoned sinking vessel.
	L. B. Clark, keeper, Cuttyhunk Light Station, Mass.....	Power boat Champion, of Newport, R. I.	Assisted in landing boat, with 2 men aboard, driven ashore by gale.
	Tender Azalea.....	Dory.....	Towed to pier dory, with 3 men aboard, caught in ice jam.
	H. L. Thomas, keeper, Nantucket (Great Point) Light Station, Mass. C. Stoll, assistant keeper, Nantucket (Great Point) Light Station.	Steamer A. T. Serrell, of Newport, R. I.	Assisted ashore crew of 8 men of disabled vessel caught in ice pack, and quartered crew at light station until arrival of Coast Guard.
	G. Bartlett, first officer, tender Azalea.		Rescued man from overturned dory and placed him aboard barge.
	Great Round Shoal Light Vessel No. 86, Mass.	Dory from schooner W. H. Moody, of Gloucester, Mass.	Rescued 2 men in exhausted condition, adrift in blizzard 30 hours, and furnished them food and lodging.
	G. A. Faulkner, keeper, Palmer Island Light Station, Mass.		Rescued from drowning 2 men from overturned skiff and cared for them until arrival of harbor police.
	Boston Light Vessel No. 54, Mass..	Motor boat.....	Rescued from drowning 3 fishermen in motor boat and furnished them food and lodging.
	A. A. Howard keeper Ipswich Range Light Station, Mass.	Schooner George M. Warner, of Yarmouth, N. S.	Furnished food, dry clothing, and lodging to captain and crew.
3d.....	Tender Pansy.....	Portland packet....	Rescued captain and 3 men in exhausted condition in small boat from abandoned vessel grounded on Romer Shoal and recovered vessel.
	do.....	Motor boat, of Poughkeepsie, N. Y.	Recovered disabled motor boat with three boys aboard and towed her to dock.
	J. F. Woods, keeper, Saybrook Breakwater Light Station, Conn.	Speed boat.....	Towed disabled speed boat, with two occupants aboard, to station.
	do.....	Schooner Silver Queen.	Rendered aid to captain with crushed hand and cared for him until arrival of doctor.
	K. Hanson, keeper; J. J. Price, first assistant keeper; and S. C. Wright, second assistant keeper, Absecon Light Station, N. J.	Yacht Cerenty.....	Assisted in getting distressed yacht off bar.
	J. H. Woods, keeper, Saybrook Breakwater Light Station, Conn.	Sloop Jolly Tar.....	Pulled sloop off shore on west side of breakwater with power boat.
	W. M. Chapel, keeper, Plum Island Light Station, N. Y.	Tug S. L. Hommedieu.	Rescued captain and wife, adrift, from sinking tug, in open boat, without oars.
	E. E. Gldersleeve, keeper, Saybrook Point Light Station, Conn.		Extinguished fire in cottage.
	J. A. Miller, keeper, Bridgeport Harbor Light Station, Conn.	Sloop Samuel C. Bond.	Assisted in getting sloop off breakwater.

SAVING OF LIFE AND PROPERTY BY VESSELS OR EMPLOYEES OF THE LIGHTHOUSE SERVICE DURING THE FISCAL YEAR 1917—Continued.

District.	Vessel or employee rendering service.	Vessel, etc., aided.	Nature of assistance.
3d.....	Tender Pansy.....	Yacht Trio; John Pierson, owner.	Towed yacht, in sinking condition, with two occupants aboard, to yacht basin, South Brooklyn, N. Y.
	E. M. Grant, keeper, Stepping Stones Light Station, N. Y.	Yacht Damascara; David M. Myers, owner.	Rescued owner and guest from disabled yacht and furnished them meal.
	S. Dodge, keeper, W. H. Clark, first assistant keeper, Block Island (southeast) Light Station, R. I.	U. S. Army hydroplane.	Assisted in saving damaged hydroplane, which alighted in surf near station, and in repairing same, and furnished occupants lodging and clothing.
	Tender John Rodgers.....	Launch Ellis, U. S. Engineers, New London, Conn.	Assisted in saving launch, near sinking, at Customhouse Wharf.
	W. F. Rhodes, keeper, and F. L. Thompson, assistant keeper, Greens Ledge Light Station, Conn.	Oyster boat.....	Assisted in extinguishing flames.
	Tender Myrtle.....	Motor boat Try On..	Towed disabled motor boat, with two men aboard, to shore.
	W. J. Murray, keeper; S. Kendzia, first assistant keeper; and J. F. Newman, second assistant keeper, Little Gull Island Light Station, N. Y.	Auxiliary sailboat, C. E. Beach, owner.	Towed boat, adrift, to station.
	Cornfield Point Light Vessel No. 48, Conn.	Small power boat...	Towed small power boat, adrift, with 1 occupant, to Saybrook Point.
4th.....	W. H. Schellenger, keeper, and C. H. Hickman, second assistant keeper, Harbor of Refuge Light Station, Del.	Motor boat.....	Recovered disabled motor boat, with 6 men aboard, blown offshore from light station.
5th.....	W. J. Tate, keeper, North Landing River, Currituck Sound, Coinjock Bay, and North River Aids, N. C.	Launch.....	Rendered assistance to disabled launch.
	Tender Jessamine.....	Schooner Jessie Irving.	Floated schooner ashore on Kent Island Shoal, Md.
	W. J. Tate, keeper, North Landing River, etc., Aids.	Schooner Hobson...	Assisted in floating schooner ashore near station.
	.....do.....	Freighter R. C. Beaman.	Rendered assistance to disabled freighter.
	.....do.....	Boat Muriel Dean...	Assisted in floating boat.
	.....do.....	Launch.....	Assisted in making emergency repairs to launch.
	.....do.....	Yacht Idlewell.....	Piloted yacht which had lost her way.
	.....do.....	.....	Assisted in repairing disabled aeroplane and provided shelter for occupants.
	.....do.....	Motor boat.....	Aided disabled boat and assisted in repairing same.
	.....do.....	.....do.....	Towed disabled motor boat to safe harbor.
	.....do.....	North Carolina Fisheries Commission boat Gretchen.	Assisted in floating boat and conveyed State fish commissioner to Coinjock, N. C.
	Tender Maple.....	Schooner Rattler, Capt. Frank Gibson.	Towed disabled and sinking schooner to harbor and rescued complement of 4 men.
	J. F. Hudgins, keeper, Neuse River Light Station, etc., N. C.	Launch.....	Rescued 9 persons from disabled launch.
	Tender Maple.....	Steamer Severn and bug-eye Mary E. Fouble.	Rendered assistance to steamer and bug-eye, which collided.
	W. H. Davis, keeper, Lazaretto Lighthouse Depot, Md.	.....do.....	Went to assistance of those on board these boats.
	C. C. Tyler, keeper, Great Shoals Light Station, Md.	Launch.....	Rendered assistance to 3 persons in disabled launch and furnished them food and shelter.
	Tender Jessamine.....	.....	Rescued man from drowning.
	W. M. Midgett, assistant keeper, Love Point Light Station, Md.	.....	Assisted in rescuing drowning man.
	W. J. Tate, keeper, North Landing River, etc., Aids, N. C.	Yacht.....	Floated stranded yacht.
	.....do.....	Yacht Abeela, of New York.	Repaired engine of yacht.
	G. M. Willis, sr., keeper, Cedar Point Light Station, Md.	Launch Jane.....	Floated launch aground on bar near light station and furnished lodging to crew.

SAVING OF LIFE AND PROPERTY BY VESSELS OR EMPLOYEES OF THE LIGHTHOUSE SERVICE DURING THE FISCAL YEAR 1917—Continued.

District.	Vessel or employee rendering service.	Vessel, etc., aided.	Nature of assistance.
5th.....	Tender Maple.....	Oyster boat Lady Eleanora.	Towed boat, anchored with masts and sails overboard, to Baltimore, Md.
	.....do.....	Schooner S. E. Lankford.	Floated schooner ashore at Mathias Point, Md.
	.....do.....	Bateau Princess.....	Went to assistance of bateau and landed crew at Annapolis, Md.
	.....do.....	Schooner Ada J. Campbell.	Went to assistance of schooner, with decks awash, and towed her to safe anchorage.
	Tender Orchid.....	Tug W. S. Embrey, of New York.	Towed disabled tug, with 5 persons aboard, to safety.
	W. Newton, keeper, Harbor Island Bar Light Station, N. C.	Schooner Lacy.....	Floated and towed schooner to harbor.
	G. G. Johnson, assistant keeper, Old Plantation Flats Light Station, Va.	Motor boat.....	Towed disabled motor boat to station, furnished occupants food, and towed boat to Cape Charles, Va.
	T. D. Quidley, keeper, Neuse River Light Station, etc., N. C.	Freight boat Olive..	Towed heavily laden freight boat to safe harbor.
	H. S. Moore, keeper, Janes Island Light Station, Md.	Skiff.....	Rendered assistance to occupants of skiff caught in ice near station and furnished them food and lodging.
	Tender Laurel.....	Motor boat.....	Towed disabled motor boat, containing 7 persons, to Washington, N. C.
	Tender Holly.....	Schooner Thomas J. Seward.	Pulled schooner ashore on Point Breemo, Va., into deep water.
	T. H. Baum, keeper, Long Shoal Light Station, N. C.	Power boat E. R. Daniels.	Assisted disabled power boat and helped repair engines.
	L. V. Gaskill, assistant keeper, Long Shoal Light Station, N. C.	.....do.....	Do.
	C. A. Sterling, keeper, Craney Island Light Station, Va.	Yacht Joan III, of Norfolk, Va.	Rescued member of crew from drowning and towed yacht to safe harbor.
6th.....	Tender Cypress.....	U. S. S. Hector.....	Rescued master and 20 others left on wrecked steamer.
	.....do.....	British S. S. Oak Branch.	Picked up moorings off Charleston Harbor and delivered them to vessel's agents in Charleston, S. C.
	.....do.....	Motor boat Acme....	Towed disabled boat, with 4 men aboard, to Charleston, S. C.
	Tender Mangrove.....	British S. S. Nevisian.	Assisted in floating vessel grounded on St. Simon Bar, Ga.
	.....do.....	Power boat Kurkimwah; W. G. Hinson, James Island, S. C., owner.	Picked up boat adrift off Fort Sumter and delivered it to Charleston Lighthouse Depot.
	Tender Snowdrop.....	Small boat.....	Rescued party of 11 persons from perilous position in Winyah Bay, S. C., and transferred them to Georgetown, S. C.
	A. F. Wichmann, keeper, Cape Romain Light Station, S. C.	Barge Northwest....	Assisted captain and 4 others washed ashore.
	J. Cromley, keeper, and R. H. Cromley, assistant keeper, Sapelo Light Station, Ga.	Schooner Perry Selzer.	Assisted schooner in distress off Sapelo Light Station and secured tug for tow to Brunswick, Ga.
	L. H. Bringle, keeper, and J. Grisillo, second assistant keeper, Charleston Light Station, S. C.	Small boat.....	Assisted 2 fishermen in breakers in reaching shore near light station.
	T. Knight, keeper; J. H. Menges, first assistant keeper; and W. E. McCreary, second assistant keeper, Hillsboro Inlet Light Station, Fla.	Motor boat.....	Rescued 3 persons from upset motor boat and furnished them clothing and food.
	T. Knight, keeper, and W. E. McCreary, second assistant keeper, Hillsboro Inlet Light Station, Fla.	Barge Hildegard; Alfred Clement, New Orleans, La., owner.	Telegraphed to Key West, Fla., for aid for grounded vessel.
	R. Helsser, keeper, Jupiter Inlet Light Station, Fla.	S. S. Sangstad, United Fruit Co., Boston, Mass., owners.	Requested aid by wireless for vessel ashore off Jupiter Inlet, Fla.
	F. Traugott, keeper, Hunting Island Light Station, S. C.	Tug Passport; Savannah River Lumber Co., Savannah, Ga., owners.	Advised owners by telegraph of disabled condition of tug near light station.

SAVING OF LIFE AND PROPERTY BY VESSELS OR EMPLOYEES OF THE LIGHTHOUSE SERVICE DURING THE FISCAL YEAR 1917—Continued.

District.	Vessel or employee rendering service.	Vessel, etc., aided.	Nature of assistance.
7th.....	Tender Snowdrop.....	Greek schooner Maria Louisa.	Rescued 5 members of crew from wreck on Dry Tortugas and transported them to Key West, Fla.
	Tender Ivy.....	.....do.....	Assisted in trying to pull wreck off shoals.
8th.....	M. W. Streckert, keeper, and O. H. Beadnell, second assistant keeper, Sand Island Light Station, Ala.	.....do.....	Maintained light during hurricane.
	M. Brown, first assistant keeper, Sand Island Light Station, Ala.	.....do.....	Saved property during hurricane.
	T. P. Roberts, assistant keeper, Aransas Pass Light Station, Tex.	.....do.....	Maintained light and protected property during hurricane.
	G. R. Smith, keeper, and L. R. Smith, assistant keeper, Red Fish Bar Cut Light Station, Tex.	Schooner Adele.....	Rescued crew of 2 men from foundered vessel and furnished them food and clothing.
	Tender Sunflower.....	S. S. Standard; Standard Oil Co., Bayonne, N. J., owners.	Floated vessel grounded in South Pass, La.
	J. W. Sprinkle, laborer in charge, Pass Aux Herons Lights, Ala.	Launch Bernice, of Point Clear, Ala.	Assisted disabled launch.
	G. R. Smith, keeper, and L. R. Smith, assistant keeper, Red Fish Bar Cut Light Station, Tex.	Launch Emmy.....	Assisted disabled launch and furnished provisions and water to occupants.
	A. Rodi, keeper, South Pass East Jetty Light Station, etc., La.	U. S. torpedo boat Flusser.	Assisted in landing crew of vessel stranded on beach near light station.
	J. H. Portman, keeper, and F. A. Schrieber, assistant keeper, Round Island Light Station, etc., Miss.	Motor boat.....	Assisted occupants of disabled boat and furnished them food and shelter.
	M. W. Streckert, keeper; M. Brown, first assistant keeper; and O. H. Beadnell, second assistant keeper, Sand Island Light Station, Ala.	Launch: Aug. Writz, owner.	Towed disabled launch to place of safety and furnished occupants fuel, food, and shelter.
	F. A. Schrieber, assistant keeper, Round Island Light Station, etc., Miss.	Small sailboat.....	Towed disabled boat to entrance of Pascagoula River.
	G. R. Smith, keeper, Red Fish Bar Cut Light Station, Tex.	Motor tug Fortune..	Rescued crew of 3 men from wreck of motor tug.
10th.....	B. A. Dissett, first assistant keeper, Toledo Harbor Light Station, Ohio.	Launch.....	Towed disabled launch to light station and furnished food to occupants.
	.....do.....	Yacht Dorel.....	Towed sunken yacht to light station and righted and towed her to Toledo, Ohio.
	G. F. Ferguson, keeper, Fort Niagara Light Station, N. Y.	.....do.....	Assisted in rescuing man adrift on the ice on Lake Ontario.
	C. Fitzmorris, keeper, West Sister Island Light Station, Ohio.	Yacht Luella; P. C. and C. A. Peters, owners.	Rescued 6 persons from capsized yacht, assisted in righting yacht, and furnished food and clothing to occupants.
	.....do.....	Launch Baby Rambler.	Furnished shelter and dry clothing to 2 men en route to Toledo, Ohio.
	.....do.....	Launch Exalta.....	Furnished 4 men from disabled launch food and lodging.
	D. D. Hill, keeper, Cross Over Island Light Station, N. Y.	Barge Brighton; Montreal Transportation Co.	Assisted in removing crew and personal effects from barge grounded near station.
	F. Ritter, keeper, Sandusky Bay Inner Range Light Station, Ohio.	Launch.....	Towed launch to safety.
	.....do.....	.....do.....	Towed disabled launch, with 7 persons aboard, to Sandusky, Ohio.
	A. Shaw, Jr., keeper, Presque Isle Light Station, Pa.	.....do.....	Prevented spreading of fire in vicinity of station.
11th.....	W. A. Burke, keeper, Saginaw River Range Light Station, Mich.	Sailboat; Earl Beutel, owner.	Towed disabled boat to safety.
	L. McDonald, first assistant keeper, and E. C. Towns, second assistant keeper, Port Austin Reef Light Station, Mich.; D. McDonald, second assistant keeper, Detroit Light Station, Mich.	.....do.....	Assisted in rescuing 3 fishermen adrift on ice.

SAVING OF LIFE AND PROPERTY BY VESSELS OR EMPLOYEES OF THE LIGHTHOUSE SERVICE DURING THE FISCAL YEAR 1917—Continued.

District.	Vessel or employee rendering service.	Vessel, etc., aided.	Nature of assistance.
11th.....	L. McDonald, first assistant keeper, and E. C. Towns, second assistant keeper, Port Austin Reef Light Station, Mich.	Gasoline fish boat; I. S. Osborn, owner.	Towed disabled boat to safety.
	H. Keondway, second assistant keeper, Fourteen Mile Point Light Station, Mich.	Motor boat Florence.	Do.
	A. McLean, keeper, and C. G. Wright, second assistant keeper, Huron Island Light Station, Mich.	Launch Petrel.....	Towed disabled motor boat adrift in a heavy sea to safety, and furnished occupants food, lodging, and dry clothing.
	W. G. Marshall, keeper, Windmill Point Light Station, Mich.	.....	Rescued man from drowning.
	F. G. Sommer, keeper, Detour Light Station, Mich.	Launch Adolph; Spencer M. Hill, owner.	Towed disabled launch to safety.
	F. Warner, keeper, Birch Point Range Lights, Mich.	Motor boat; R. V. Duncan, owner.	Recovered disabled boat adrift in violent gale.
	N. Abear, keeper, Frying Pan Island Light Station, Mich.	Tug Rambler.....	Furnished food to passengers of tug caught in ice and brought passengers and mail ashore.
	.....do.....	Motor boat; M. J. Andress, owner.	Towed disabled boat to safety.
	E. C. Byrne, first assistant keeper, Point Iroquois Light Station, Mich.	Motor boat; John Evans, owner.	Towed leaky boat to safety and furnished occupants food and lodging.
	C. T. Davis, keeper, Copper Harbor Range Lights, Mich.	Canoe.....	Furnished food and dry clothing to man from capsized canoe.
12th.....	T. E. Martin, assistant keeper, Michigan City Light Station, Ind.	.....	Rescued from drowning man and boy fallen off pier.
	T. J. Armstrong, keeper, Michigan City Light Station, Ind.	.....	Rescued from drowning boy fallen off pier.
	O. C. McCauley, keeper, and C. Lonnis, first assistant keeper, Squaw Island Light Station, Mich.	Launch Phyllis; J. Brown, owner, Scotts Point, Mich.	Towed disabled boat with 2 occupants ashore.
	J. H. Sullivan, second assistant keeper, White Shoal Light Station, Mich.	Motor boat.....	Towed disabled motor boat into harbor.
	E. H. Cornell, keeper, and J. Fitzgerald, assistant keeper, Pottawatomie Light Station, Wis.	Steamer Peter Reiss.	Notified Coast Guard and delivered messages to stranded steamer.
	O. C. McCauley, keeper, Squaw Island Light Station, Mich.	Fish tug Margaret McCann.	Towed disabled boat 5 miles into harbor.
	R. F. Wright, first assistant keeper, Manitowoc Light Station, Wis.	Launch Manowis....	Assisted in releasing launch that had beached.
	J. W. Barrand, mate, and R. Peterson, cook, Eleven Foot Shoal Light Vessel No. 60, Mich.	.....	Rescued from drowning man fallen into water from the ice.
	L. Gronning, laborer, Chicago Pierhead Range Light Station, Ill.	.....	Rescued from drowning man fallen off pier.
	W. Donovan, first assistant keeper, and S. O. Thorrien, laborer, Chicago Harbor Light Station, Ill.	Launch Thetis, City of Chicago.	Pulled stranded launch off breakwater and towed her to light station; notified Coast Guard.
	P. Sheridan, keeper, Chicago Harbor Light Station, Ill.	Launch May.....	Furnished gasoline to launch in danger of drifting on breakwater; towed her to another vessel.
	L. Gronning, laborer, Chicago Pierhead Range Light Station, Ill.	.....	Assisted in rescuing man blown off pier by wind.
	J. K. Robinson, keeper, Calumet Harbor Light Station, Ill.	.....	Rescued woman from drowning.
	J. H. Nelson, first assistant keeper, Calumet Harbor Light Station, Ill.	Motor boat Sea Gull, U. S. Engineer Department.	Assisted in rendering aid to disabled boat.
	E. C. Sterritt, keeper, Twin River Point Light Station, Wis.	Motor boat Ann Ella.	Notified Coast Guard, who rendered assistance to disabled motor boat.
	R. W. Johnson, keeper, and M. Telgard, first assistant keeper, North Manitou Light Station, Mich.	Motor boat Teal; Peter Stormer, owner.	Towed disabled boat, with 3 men aboard, to shore and furnished them gasoline.
16th.....	Tender Fern.....	S. S. Admiral Farragut; Pacific Alaska Navigation Co., E. D. Hickman, master.	Removed passengers and assisted in pulling grounded vessel clear on flood tide.
	D. O. Kinyon, keeper, Guard Island Light Station, Alaska.	Motor boat.....	Towed to station.

SAVING OF LIFE AND PROPERTY BY VESSELS OR EMPLOYEES OF THE LIGHTHOUSE SERVICE DURING THE FISCAL YEAR 1917—Continued.

District.	Vessel or employee rendering service.	Vessel, etc., aided.	Nature of assistance.
16th.....	R. McKlem, keeper; G. Alexius, first assistant keeper; and J. C. Jespersen, second assistant keeper, Eldred Rock Light Station, Alaska.	Fish-trap watchman, Chilkoot cannery.	Conveyed injured man to station and took him to Haines, Alaska, for medical treatment.
	D. O. Kinyon, keeper, Guard Island Light Station, Alaska.	Launch Holdahl 2nd	Furnished occupants gasoline.
	S. G. Olsen, keeper; E. Pecor, first assistant keeper; and W. J. Morgan, second assistant keeper, Cape Hinchinbrook Light Station, Alaska.	.....	Furnished shelter, clothing, and subsistence to shipwrecked and stormbound native mail carriers.
	S. F. Shepard, keeper, Mary Island Light Station, Alaska.	Motorboat Retriever; Chas. Baker, owner.	Furnished gasoline to occupants.
	Tender Fern.....	Barge Henry Villard; James Griffiths & Sons, owners.	Towed barge into Ketchikan, Alaska.
17th.....	Columbia River Light Vessel No. 88, Oreg.	Fishing boat Nara...	Rendered assistance to boat containing 2 men.
	J. E. Thomas, keeper, and H. J. Williams, assistant keeper, Ediz Hook Light Station, Wash.	Launch.....	Towed disabled launch, containing 2 men, to safe anchorage.
	L. A. Petterson, keeper, West Point Light Station, Wash.	Sailboat Mist; George DeBritz, owner.	Towed disabled boat off rocks near station to Ballard, Wash., for repairs.
18th.....	G. A. Cobb, keeper, and T. S. Thomson, assistant keeper, Humboldt Bay Fog Signal Station, Cal.	U. S. submarine H-3	Assisted in rescuing 27 men from vessel ashore.
19th.....	Tender Columbine.....	.....	Searched for Army launch lost off Oahu Island.
	.....do.....	Schooner Muriel.....	Towed grounded schooner, with 2 lighters, to safe anchorage and floated her by lightering cargo.

DAMAGE BY COLLISIONS.

On November 24, 1916, Pollock Rip Light Vessel No. 47, Mass., was fouled by a barge in tow of the tug *Calvert*. Cost of repairs in the sum of \$494 was paid by the owners of the vessel.

On January 13, 1917, Stone Horse Shoal Light Vessel No. 5, Mass., was fouled by the barge *Belfast* in tow of the tug *William B. Keene*, causing damages to the extent of \$463, which amount was paid by the owners of the tug.

On January 19, 1917, Pollock Rip Light Vessel No. 47, Mass., was fouled by a barge in tow of the tug *Standard*. Cost of repairs in the sum of \$1,204.28 was paid by the owners of the tug.

On January 21, 1917, Handkerchief Light Vessel No. 3, Mass., was fouled by the barge *Nanticoke* in tow of the tug *Tacony*. The owners of the tug have agreed to pay for the damages, estimated at about \$650.

On July 8, 1916, Sheepshead Bay Outer Light was run into by the steamer *Giralda*. Damage to the light in the amount of \$218.61 was paid by the owner of the vessel.

On October 21, 1916, the American S. S. *Moldegaard* collided with and sunk Joe Flogger Shoal Gas and Bell Buoy 11A. Cost of repairs in the sum of \$576.89 was paid by the owners of the vessel.

On October 30, 1916, the British S. S. *Panama Transport* collided with the upstream wharf at Fort Mifflin, Pa., causing damage to lighthouse property to the extent of \$230.28. Steps have been taken to have the damage paid for by the owners of the vessel.

On September 1, 1916, Aaron Shoal Beacon Light, Va., was collided with and completely destroyed by the tugboat *W. W. Graham*. The beacon was rebuilt by the owners of the tug at an estimated cost of \$225.

On November 29, 1916, Brewerton Channel Gas Buoy No. 8B was collided with by the S. S. *Melrose*, causing damage to the buoy in the estimated amount of \$280.40, which was paid by the owners of the vessel.

On December 18, 1916, Cape Charles Light Vessel No. 101, Va., was collided with by the Danish motorship *Oregon*, causing damage to the light vessel in the estimated amount of \$3,500. The cost of repairs have been paid by the owners of the vessel.

On January 6, 1917, Croatan Light Station, N. C., was collided with by the tug *Curtin* with four barges in tow, causing damage to the light station in the estimated amount of \$120, which the owner of the tug has agreed to pay for.

On January 15, 1917, an auto truck used at the Portsmouth Lighthouse Depot, Va., collided with a street car, causing damages to the auto truck to the extent of \$133.60. Steps have been taken to have the damage paid for by the street car company.

On February 7, 1917, Curtis Bay Entrance Buoy 5M was collided with by the S. S. *Sherman*, inflicting damages in the estimated amount of \$185, which the owners of the vessel have agreed to pay.

On October 1, 1916, Charleston Light Vessel No. 34, S. C., was struck by a lighter in tow of the tug *Bee*, causing damages to the light vessel in the amount of \$894.20. The claim was compromised.

On November 21, 1916, Forrester Point Lower Range Front Light No. 62, St. Johns River, Fla., was damaged by the S. S. *Osceola* in the amount of \$100, which was paid by the Government.

On December 26, 1916, Forrester Point Upper Range Front Light No. 66, St. Johns River, Fla., was damaged by the steamer *Clivedon* in the amount of \$100. The claim was compromised.

On April 8, 1917, New Channel Range Front Light, N. C., was damaged by the houseboat *Everglades* in the amount of \$887. Efforts are being made to have the owner of the vessel pay for the damages.

On April 8, 1917, Battery Island Light No. 2A, N. C., was damaged by the houseboat *Everglades*. Efforts are being made to have the owner of the vessel pay for the damages amounting to \$775.

On October 21, 1916, Nashua Light No. 84, Fla., was damaged by a tow of the tug *Resolute*. The light was rebuilt by the Government at a cost of \$100.

On September 12, 1916, Mackey Point Light, Savannah, Ga., was damaged by boat of contractor engaged in dredging Savannah River. The structure was rebuilt by the owners of the boat at a cost of about \$100.

On July 29, 1916, Galveston Bay Channel Range Front Light, Tex., was collided with by a barge in tow of the tug *Wm. J. Kelley*. The cost of repairs, \$171.82, was paid by the owners of the tug.

On June 7, 1917, the tower of Cleveland West Pier Light, Ohio, was destroyed by the steamer *J. C. Morse*, in tow of tugs *Frank W* and *Lorain*. The tower will be replaced by the owners of the tugs at an estimated cost of \$850.

On May 23, 1917, the tender *Crocus* was struck by the steamer *City of Detroit III* in tow of the tugs *Pennsylvania* and *Georgia*, inflicting damages estimated at \$475. The responsible parties authorized the necessary repairs, which have been completed.

On June 5, 1916, Middle Ground Southwest Buoy 9, St. Marys River, Mich., was carried away by the steamer *Moses Taylor*. The owners of the steamer paid the cost of replacing the buoy, \$139.54.

On June 17, 1917, Livingstone Channel Gas Buoy 3B, Detroit River, Mich., was collided with by the tug *Gladiator*, with dredge and scow in tow, inflicting damages to the buoy to the extent of \$279.79, which were paid for by the owners of the tug.

On August 28, 1916, Redwood Creek Beacon No. 1, Cal., was collided with by an unknown vessel. The beacon was replaced at the expense of the Government at a cost of \$148.20.

On September 28, 1916, Deadmans Island Breakwater Light No. 4, Cal., was collided with by an unknown vessel, causing damage to the light in the estimated amount of \$600.

On September 26, 1916, Alviso Channel Beacon No. 9, Cal., was collided with by an unknown vessel. The beacon was replaced by the Government at a cost of \$148.20.

On October 19, 1916, Petaluma Creek Light No. 1, Cal., was knocked down by the tug *Lou Chandler* with a barge in tow, causing damage to the light in the estimated amount of \$600. The light was rebuilt by the owners of the barge.

On December 31, 1916, San Diego Bay Beacon No. 1, Cal., was collided with by the steamer *Saginaw*, inflicting damages to the beacon in the amount of \$220, which were paid for by the owners of the vessel.

On January 21, 1917, Indian Island Spit Light, Cal., was collided with by the steamer *Antelope*, destroying the lens lantern and doing other damage to the structure. The entire cost of repairs was borne by the owners of the vessel.

On April 19, 1917, San Diego Bay Light No. 6, Cal., was collided with by the tug *Bahada*, causing damages estimated at \$600. Steps have been taken to have the owners of the tug make the necessary repairs.

The following damage to private property was caused by vessels of the Lighthouse Service during the year:

On April 10, 1917, relief light vessel No. 66, Mass., collided with the end of the dock of the Metropolitan Coal Co., inflicting damages to the dock estimated at \$100.

On June 21, 1917, Great Round Shoal Light Vessel No. 86, Mass., collided with the end of the wharf of the Pocahontas Fuel Co., inflicting damages to the wharf estimated at \$125.

On May 25, 1917, the tender *Dandelion* collided with launch owned by Arthur Hugins, inflicting damages to the launch in the estimated amount of \$25.

The Lighthouse Service was responsible for these three collisions, and in accordance with section 4 of the act approved June 17, 1910 (36 Stat., 537), estimates will be submitted to Congress in the amounts mentioned.

PUBLICATIONS OF THE LIGHTHOUSE SERVICE.

[All publications are at present distributed free.]

Publications.	Date of last edition.	Cost of last edition.	Number distributed.
Light lists:			
Atlantic and Gulf coasts of United States.....	Jan. 1, 1917	\$4,270	9,158
Pacific coast of United States, etc.....	do.	1,289	2,437
Great Lakes of United States and Canada.....	Apr. 1, 1917	849	1,321
Upper Mississippi River and tributaries.....	Jan. 15, 1917	546	988
Ohio River and tributaries.....	Sept. 15, 1916	126	873
Lower Mississippi River and tributaries.....	Oct. 15, 1916	283	694
Buoy lists:			
First district.....	May 1, 1916	942	4,813
Second district.....	do.	739	5,100
Third district.....	May 1, 1917	1,446	5,252
Fourth district.....	June 1, 1917	345	3,773
Fifth district.....	July 1, 1917	1,800	3,998
Sixth district.....	Mar. 1, 1916	728	3,015
Seventh district.....	Apr. 1, 1916	414	3,476
Eighth district.....	Sept. 1, 1916	704	2,896
Ninth district.....	July 1, 1917	130	1,024
Tenth district.....	Apr. 1, 1917	211	1,195
Eleventh district.....	do.	531	1,100
Twelfth district.....	do.	349	1,125
Sixteenth district.....	June 1, 1917	315	501
Seventeenth district.....	June 1, 1916	476	1,258
Eighteenth district.....	do.	260	1,315
Nineteenth district.....	July 1, 1917	157	990
Miscellaneous publications:			
Weekly Notice to Mariners.....	1917	3,584	170,800
Annual Report, Commissioner of Lighthouses-			
Part I.....	1916	691	1,170
Part II.....	1916	352	
Regulations for the United States Lighthouse Service.....	1914	787	36
Medical handbook.....	1915	633	119
Lighthouse Service bulletins.....	1917	205	18,000
Regulations for lighting bridges.....	1915	202	129
Regulations for uniforms.....	1912	70	3
Civil-service regulations.....	1913	73	2
Instructions for cost-keeping.....	1914	120	50
Instructions to employees.....	1915	408	55
The United States Lighthouse Service.....	1915	508	217

COST OF PRINTING FOR THE LIGHTHOUSE SERVICE DURING THE FISCAL YEAR 1917.

Light lists.....	\$7,835.95
Buoy lists.....	5,430.37
Notices to mariners.....	3,743.12
Annual Report, Part I.....	691.41
Annual Report, Part II.....	352.04
Specifications and other publications.....	264.48
Forms, reports, record books, etc.....	4,777.73
Total.....	23,095.10

**MONEY RECEIVED BY THE LIGHTHOUSE SERVICE AND TURNED INTO
THE TREASURY, FISCAL YEAR 1917.**

District.	From sales of property.	From damages to aids to navigation and other property.	From leases and rentals.	Total.
1st.....	\$1,046.48			\$1,046.48
2d.....	1,000.00	\$96.28	\$161.91	1,258.19
3d.....	4,394.44	571.95	359.00	5,325.39
4th.....	399.33	94.13	5.00	498.46
5th.....	4,423.29	25.00		4,448.29
6th.....	169.61	89.29	24.80	583.70
7th.....	269.04		132.90	401.94
8th.....	367.50	516.28	20.00	903.78
10th.....	459.24	74.43	468.49	1,002.16
11th.....	1,239.66	18.44	1,061.49	2,319.59
12th.....	447.45		1.00	448.45
14th.....	28.00			28.00
16th.....	292.56	63.00		355.56
17th.....	320.62	474.15	315.00	1,109.77
18th.....	1,841.37	438.50	1,939.50	4,219.37
19th.....	40.00			40.00
Bureau.....		105.07		105.07
Total.....	17,038.59	2,566.52	4,489.09	24,094.20

**APPROPRIATIONS FOR THE BUREAU OF LIGHTHOUSES AND THE
LIGHTHOUSE SERVICE, SIXTY-FOURTH CONGRESS, SECOND SESSION,
AND SIXTY-FIFTH CONGRESS, FIRST SESSION, 1916-17.**

Title.	Act.	Amount.
Maintenance:		
Salaries, Bureau of Lighthouses, 1918.....	Legislative, Mar. 3, 1917.....	\$64,000
General expenses, Lighthouse Service, 1918.....	Sundry civil, June 12, 1917.....	2,850,000
Salaries of keepers of lighthouses, 1918.....	do.....	940,000
Salaries, lighthouse vessels, 1918.....	do.....	1,104,650
Salaries, Lighthouse Service, 1918.....	do.....	380,000
Total for maintenance.....		5,338,650
Special works:		
Light vessels for general lake service.....	Sundry civil, June 12, 1917.....	150,000
Radio installations on lighthouse tenders.....	do.....	60,000
Staten Island Lighthouse Depot, N. Y.....	do.....	21,000
Tender for third lighthouse district.....	do.....	150,000
Aids to navigation, East River, N. Y.....	do.....	16,000
Great Salt Pond Light Station, R. I.....	do.....	20,000
Cape Charles Light Vessel, Va.....	do.....	130,000
Aids to navigation, Cape Charles City, Va.....	do.....	12,800
Aids to navigation, Chesapeake Bay, Md. and Va.....	do.....	29,000
Point Borinquen Light Station, P. R.....	do.....	85,000
Aids to navigation, Huron Harbor, Ohio.....	do.....	4,500
Aids to navigation, Fairport Harbor, Ohio.....	do.....	42,000
Sand Hills Light Station, Mich.....	do.....	70,000
Aids to navigation, Keweenaw Waterway, Mich.....	do.....	105,000
Chicago Harbor Light Station, Ill.....	do.....	88,000
Manitowoc Breakwater Light Station, Wis.....	do.....	21,000
Aids to navigation, Indiana Harbor, Ind.....	do.....	100,000
Aids to navigation, Alaska.....	do.....	60,000
Aids to navigation, Washington and Oregon.....	do.....	35,000
Aids to navigation, Pearl Harbor, Hawaii.....	do.....	80,000
Aransas Pass Light Station, Tex.....	Urgent deficiency, Oct. 6, 1917.....	20,000
Total for special works.....		1,259,300
Grand total.....		6,597,950

EXPENDITURES DURING THE FISCAL YEAR 1917 FROM APPROPRIATIONS FOR THE LIGHTHOUSE SERVICE.

[Obligations incurred are not included.]

MAINTENANCE APPROPRIATIONS.

Salaries:

Bureau of Lighthouses, 1916.....	\$2,834.65
Bureau of Lighthouses, 1917.....	58,778.22
Expenses of buoyage: Certified claims.....	45.64
Supplies of lighthouses: Certified claims.....	61.84
Salaries of keepers of lighthouses:	
1916.....	23,797.64
1917.....	903,643.22
Lighting of rivers: Certified claims.....	12.89
Salaries, lighthouse vessels:	
1916.....	28,488.70
1917.....	998,584.48
Expenses of light vessels: Certified claims.....	24.48
Salaries, Lighthouse Service:	
1916.....	3,796.58
1917.....	362,981.89
General expenses, Lighthouse Service:	
1915.....	22,345.38
1916.....	491,276.34
1917.....	2,323,542.82
Certified claims.....	258.30
Total maintenance.....	<u>5,220,473.07</u>

SPECIAL WORKS.

General:

Tender for first lighthouse district.....	56,385.42
Tender for fifteenth lighthouse district.....	678.80
Light vessels for general service.....	64,438.38
Lighthouse tender, general service.....	78,711.22
Oil houses for light stations.....	873.62
Claims for damages by collision with lighthouse vessels.....	56.88
Second district:	
Cape Cod Canal Lights, Mass.....	2,872.28
Woods Hole Lighthouse Depot, Mass.....	33,171.69
Third district:	
Staten Island Lighthouse Depot, N. Y. (carpenter shop).....	10,915.30
Newark Bay Beacon Lights, N. J.....	1,538.38
Aids to Navigation, Hudson River, N. Y.....	40.66
Hunts Point Light Station, N. Y.....	3,520.21
Fourth district:	
Aids to navigation, Delaware River, Pa. and Del.....	14,599.06
Fifth district:	
Thimble Shoal Light Station, Va.....	70.94
Lighting Norfolk Harbor, Va.....	1,537.08
Fort McHenry Channel Range Lights, Md.....	446.77
Sixth district:	
Tender for engineer, sixth lighthouse district.....	23,173.90
Depot for sixth lighthouse district.....	4,697.89
Aids to navigation, St. Johns River, Fla.....	12,406.50
Seventh district:	
Aids to navigation, Florida Reefs, Fla.....	1,127.00
Eighth district:	
Tender and barge, eighth lighthouse district.....	13.14
Galveston Jetty Light Station, Tex.....	1,347.34
Southwest Pass Light Vessel, Mississippi River, La.....	44,326.00
Aids to navigation, Atchafalaya Entrance Channel, La.....	13,091.90
Repairing and rebuilding aids to navigation, Gulf of Mexico.....	119,575.56
Aids to navigation, Mississippi River, La.....	567.57
Ninth district:	
Navassa Island Light Station, W. I.....	56,050.16

Tenth district:	
Cleveland Fog-Signal Station, Ohio.....	\$4,300.13
Aids to navigation, Ashtabula Harbor, Ohio.....	11,656.74
Aids to navigation, Lorain Harbor, Ohio.....	27,340.37
Aids to navigation, Conneaut Harbor, Ohio.....	704.43
Aids to navigation, Toledo Harbor, Ohio.....	143.00
Eleventh district:	
Aids to navigation, Fighting Island Channel, Mich.....	8,399.25
Detroit River lights, Mich.....	930.16
Superior Pierhead Range Lights, Wis.....	124.58
Twelfth district:	
Milwaukee Light Vessel, Wis.....	240.00
Aids to navigation, Manistique, Mich.....	1,250.33
Sixteenth district:	
Aids to navigation, Alaska.....	8,194.71
Cape St. Elias Light Station, Alaska.....	35,247.32
Seventeenth district:	
Aids to navigation, Puget Sound, Wash.....	5,226.14
Aids to navigation, Coquille River, Oreg.....	36.34
Kellett Bluff Light Station, Wash.....	1,258.34
Eighteenth district:	
Point Vincente Light Station, Cal.....	13.50
Total, special works.....	651,298.99
Total, maintenance appropriations.....	5,220,473.07
Total, special works.....	651,298.99
Grand total.....	5,871,772.06

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ITEMIZED ESTIMATES OF APPROPRIATIONS FOR THE FISCAL YEAR 1919, AND ITEMIZED STATEMENT OF EXPENDITURES FOR THE FISCAL YEAR 1917, AS REQUIRED BY THE ACT OF CONGRESS APPROVED JUNE 25, 1910 (36 STAT., 755).

[The expenditures herein stated are in part estimated, owing to the fact that all obligations incurred for the year 1917 have not yet been settled. Articles of supplies purchased for general stock have also been distributed, approximately, to features to be benefited. This table refers to appropriations made in the sundry civil appropriation act and does not include Bureau salaries in Washington nor the cost of publications, otherwise provided for. This statement contains also amounts for salaries and wages under certain items which are shown separately in the Book of Estimates, 1919.]

Item.	Estimate, 1919.	Expenditures, 1917.	Item.	Estimate, 1919.	Expenditures, 1917.
GENERAL EXPENSES, LIGHTHOUSE SERVICE.			GENERAL EXPENSES, LIGHTHOUSE SERVICE—contd.		
Lights and fog signals:			Offices—Continued.		
Rations and provisions.....	\$228,200	\$161,232	Telegraph and telephone....	\$8,500	\$8,468
Fuel and rent for keepers...	74,000	56,783	Traveling expenses and mileage.....	37,000	35,821
General supplies.....	315,000	226,812	Rent.....	3,000	2,764
Repairs and improvements, including grounds and outbuildings.....	420,000	349,855	Freight, expressage, and cartage.....	35,000	34,100
Establishing lights and fog signals, including sites....	52,000	33,254	Motorcycle, Hawaiian Islands.....	100	75
Necessary additional land for light stations.....	1,500	300	Incidental expenses.....	3,100	2,536
Oil and carbide houses.....	2,000	1,201	Total.....	3,608,800	2,788,030
Incidental expenses.....	8,000	11,022	Appropriation, 1918, \$2,850,000.		
Daymarks and spindles:			Appropriation, 1917, 2,790,000.		
Establishment, including sites.....	2,000	5,200	SALARIES OF KEEPERS OF LIGHTHOUSES.		
Repairs and improvements.	10,000	6,845	Salaries of lighthouse keepers.	1,080,000	933,525
Incidental expenses.....	250	78	Appropriation, 1918, \$940,000...		
Post lights:			Appropriation, 1917, 940,000...		
Establishment.....	9,100	2,897	SALARIES, LIGHTHOUSE VESSELS.		
Wages of laborers attending lights.....	225,000	223,136	Salaries and wages, lighthouse tenders.....	1,110,000	667,654
Supplies.....	30,000	29,236	Salaries and wages, light vessels.....	540,000	373,813
Repairs and improvements.	23,000	21,979	Total.....	1,650,000	1,041,467
Incidental expenses.....	1,000	1,181	Appropriation, 1918, \$1,104,650.		
Buoys:			Appropriation, 1917, 1,070,000.		
Establishment.....	215,150	83,537	SALARIES, LIGHTHOUSE SERVICE.		
Supplies.....	42,000	24,299	Salaries, executive and technical.....	141,000	125,656
Repairs.....	66,000	49,662	Salaries, clerical and messenger.....	141,000	136,089
Incidental expenses.....	750	969	Salaries, authorized depot force.....	109,000	106,323
Tenders:			Total.....	391,000	368,068
Rations and provisions.....	294,000	202,501	Appropriation, 1918, \$380,000.		
Supplies.....	492,800	381,115	Appropriation, 1917, 375,000.		
Repairs.....	247,000	224,636			
Incidental expenses.....	6,000	5,709			
Light vessels:					
Rations and provisions.....	133,000	95,198			
Supplies.....	161,000	119,331			
Repairs.....	192,000	156,044			
Incidental expenses.....	2,000	1,118			
Depots:					
Pay of laborers and mechanics.....	80,000	60,945			
Rent.....	5,500	4,860			
Repairs and improvements.	144,000	129,767			
Incidental expenses.....	17,000	18,431			
Offices:					
Technical books and periodicals.....	500	571			
Stationery and office supplies.....	22,300	12,562			

NOTE.—Under appropriation "General Expenses, Lighthouse Service," it is proposed during the fiscal year 1919 to authorize per diem in lieu of subsistence, pursuant to the act of August 1, 1914, at rates of from \$2 to \$4.

SUMMARY OF ESTIMATES OF APPROPRIATIONS FOR THE LIGHTHOUSE SERVICE FOR THE FISCAL YEAR 1919.

FOR GENERAL MAINTENANCE OF THE LIGHTHOUSE SERVICE.

Salaries, Bureau of Lighthouses.....	\$67, 030
General expenses, Lighthouse Service.....	3, 608, 800
Salaries, Lighthouse Service.....	391, 000
Salaries, keepers of lighthouses.....	1, 080, 000
Salaries, lighthouse vessels.....	1, 650, 000
Total.....	<u>6, 796, 830</u>

FOR SPECIAL WORKS.

Group 1. Works urgently necessary for the safety or immediate needs of navigation and for the preservation of existing structures or equipment, for the full utilization of other public improvements, or for the efficient equipment of the Lighthouse Service:

1. Guantanamo, Cuba, improvements.....	14, 000
2. Lighthouse depot for second district, construction.....	85, 000
3. Detroit, Mich., improvements to lighthouse depot.....	53, 000
4. Hawaiian Islands lighthouse depot, construction and equipment..	90, 000
5. Light-keepers' dwellings, construction.....	75, 000

NOTE.—All of the foregoing items have been authorized by law.

6. Sand Island Light Station, Ala., improvements.....	45, 000
7. Light vessel for Gulf coast, Louisiana, or for general service.....	160, 000
8. Spectacle Reef Light Station, Mich., improvements.....	28, 000
9. Lighthouse depot for fifth district, enlargement, improvement, or establishment of new depot.....	275, 000
10. Lighthouse tender, to replace tender <i>John Rodgers</i> , or for general service.....	200, 000
11. Lighthouse tender, to replace tender <i>Jessamine</i> , or for general service.....	200, 000
12. Ambrose Channel, N. Y., aids to navigation.....	26, 000
13. Joe Flogger Shoal, N. J. and Del., aids to navigation.....	40, 000
14. St. Marys River, Mich., aids to navigation.....	80, 000
15. Staten Island Lighthouse Depot, N. Y., improvements.....	30, 000
16. Additional gas buoys, fifth lighthouse district.....	65, 000
17. Lighthouse tender to replace tender <i>Holly</i> , or for general service..	200, 000
18. Virgin Islands, West Indies, aids to navigation.....	50, 000
19. Staten Island Lighthouse Depot, N. Y., improvement and extension of wharves.....	120, 000
20. Potomac River, Md., aids to navigation.....	95, 000
Authorized by law.....	317, 000
Not authorized.....	1, 614, 000

Total, group 1..... 1, 931, 000

Group 2. Works considered essential for the needs of navigation and the equipment of the Lighthouse Service, and which it is recommended be undertaken as resources permit, are submitted with estimates of cost. (These items have been selected from a much larger number of recommendations submitted by the inspectors of the lighthouse districts and others.)

21. Charleston Lighthouse Depot, S. C., improvements.....	75, 000
22. Key West Lighthouse Depot, Fla., establishing.....	175, 000
23. New Orleans Lighthouse Depot, La., establishing.....	105, 000
24. Ludington, Mich., aids to navigation.....	43, 000
25. Tampa Bay, Fla., aids to navigation.....	15, 000
26. Delaware Bay entrance, improvement of aids to navigation.....	148, 000
27. Goose Island Flats, N. J., establishment of light and fog-signal station.....	140, 000
28. Alaska, lighthouse depot, purchase of site and construction and equipment.....	90, 000
29. California and Nevada, aids to navigation.....	30, 000
30. Goat Island Lighthouse Depot, Cal., improvements.....	55, 000
31. Point Pinos Light Station, Cal., improvement.....	35, 000
32. Michigan Island, Wis., establishment of light and fog-signal station.....	100, 000

Group 2—Continued.

33. Kauhola Point Light Station, Hawaii, improvement.....	\$20, 000
34. Anacapa Island, Cal., establishment of light and fog-signal station.....	115, 000
35. Santa Babara Light Station, Cal., improvements.....	28, 000
36. Cape Spencer, Alaska, establishment of light and fog-signal station.....	125, 000
37. Staten Island Lighthouse Depot, N. Y., drydock.....	130, 000
38. Portage Lake, Mich., establishment of light and fog-signal station and improvement of aids.....	100, 000
39. Ram Island, Me., establishment of light.....	3, 500
40. Cape Kumukahi, Hawaii, establishment of light.....	22, 000
41. Henderson Point, Me., establishment of light and fog signal.....	4, 900
42. Port Real, P. R., establishment of light station.....	40, 000
43. Nine Mile Point, Mich., establishment of light and fog-signal station.....	50, 000
44. Caribbean Sea, aids to navigation.....	75, 000
45. Galveston Jetty Light Station, Tex., improvements.....	8, 500
46. Grays Harbor Light Station, Wash., improvements.....	15, 000

Total, group 2 (not included in total of estimates)..... 1, 747, 900

RECAPITULATION.

For general maintenance of the Lighthouse Service.....	6, 796, 830
For special works: Group 1.....	1, 931, 000
Total.....	8, 727, 830

DETAILED ESTIMATES FOR MAINTENANCE, 1919.

BUREAU OF LIGHTHOUSES.

Salaries.....	\$67, 030
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GENERAL EXPENSES, LIGHTHOUSE SERVICE.

For supplies, repairs, maintenance, and incidental expenses of lighthouses and other lights, beacons, buoyage, fog signals, lighting of rivers heretofore authorized to be lighted, light vessels, other aids to navigation, and lighthouse tenders, including the establishment, repair, and improvement of beacons and day marks and purchase of land for same; the establishment of post lights, buoys, submarine signals, and fog signals; the establishment of oil or carbide houses not to exceed \$10,000: *Provided*, That any oil or carbide house erected hereunder shall not exceed \$550 in cost; the construction of necessary outbuildings at a cost not exceeding \$500 at any one light station in any fiscal year; the improvements of grounds and buildings connected with light stations and depots; rebuilding light stations and depots and buildings connected therewith; wages of laborers attending post lights; pay of temporary employees and field force while engaged on works of general repair and maintenance and pay of laborers and mechanics at lighthouse depots; rations and provisions or commutation thereof for keepers of lighthouses, working parties in the field, officers and crews of light vessels and tenders, and officials and other authorized persons of the Lighthouse Service on duty on board of such tenders or vessels; and money accruing from commutation for rations and provisions for the above-named persons on board of tenders and light vessels or in working parties in the field may be paid on proper vouchers to the person having charge of the mess of such vessel or party, reimbursement under rules prescribed by the Secretary of Commerce of keepers of light stations and masters of light vessels and of lighthouse tenders for rations and provisions and clothing furnished shipwrecked persons who may be temporarily provided for by them, not exceeding in all \$5,000 in any fiscal year; fuel and rent of quarters where necessary for keepers of lighthouses; the purchase of land sites for fog signals; the rent of necessary ground for all such lights and beacons as are for temporary use or to mark changeable channels and which in consequence can not be made permanent; the rent of offices, depots, and wharves; traveling expenses, mileage, library books for light stations and vessels, and technical books and periodicals not exceeding \$1,000; and for all other contingent expenses of district offices and depots and not exceeding \$10,000 for contingent expenses of the Office of the Bureau of Lighthouses in Washington, \$3,608,800.

Hereafter the appropriation, "General expenses, Lighthouse Service," shall be available, under regulations prescribed by the Secretary of Commerce, for the payment of traveling and subsistence expenses of teachers while actually employed by States or private persons to instruct the children of keepers of lighthouses.

Hereafter all officers and employees engaged in the field service or on vessels of the Lighthouse Service who shall have reached the age of 65 years, after having been 30 years in the active service of the Government, may, at their option, be retired from further performance of duty; and all such officers and employees who shall have reached the age of 70 years shall be compulsorily retired from further performance of duty: *Provided*, That the annual compensation of persons so retired shall be a sum equal to one-fortieth of the last annual pay received for each year of active service in the Lighthouse Service, or in a department or branch of the Government having a retirement system, not to exceed in any case thirty-fortieths of the last annual pay received: *Provided further*, That such retirement pay shall not include any amount on account of subsistence or other allowance.

Hereafter every lighthouse keeper and assistant lighthouse keeper in the Lighthouse Service of the United States shall be entitled to receive one ration per day, or, in the discretion of the Commissioner of Lighthouses, commutation therefor at the rate of 45 cents per ration.

Hereafter the Secretary of Commerce is authorized to provide, under regulations to be prescribed by him, for the sale of publications of the Bureau of Lighthouses and the Lighthouse Service, including the allowance of a commission for such sales.

Hereafter post-lantern lights and other aids to navigation may be established and maintained, in the discretion of the Commissioner of Lighthouses, out of the annual appropriations for the Lighthouse Service on Lakes Union and Washington, in the State of Washington.

NOTE.—The amount estimated for is \$758,800 in excess of the appropriation for the fiscal year 1917, made necessary on account of the general expansion of the Service and the great advance in the cost of all commodities.

An increase of appropriation is considered necessary on account of the increase in numbers of aids required for the safety of navigation, to keep the Lighthouse Service in an economical state of repair and efficiency, and because of the recent extraordinary advance in the price of labor and materials. The total number of aids was increased in 1917 from 14,947 to 15,222, an increase of 275, or 1.9 per cent. In order to keep pace with the constant development of commerce it is believed that proper provision for maintenance and repair as well as for the establishment of necessary additional minor aids frequently requested by mariners should be made. With the increasing numbers of requests for aids, it is impossible to render the full efficiency and service demanded unless adequate provision is made for funds. With respect to the general advance in prices of commodities, it may be stated that many items, such as steel plate and paints and paint materials, have advanced as high as three or four times normal figures, while practically all articles have advanced 25 per cent or over. It has been found necessary to estimate on a 40 per cent increase for all items in the appropriations covering the purchase of supplies and materials. Further expense will be incurred by the taking over of the lighthouse service of the Virgin Islands, West Indies, under Executive order of July 20, 1917. It is, therefore, believed that the additional amount requested is conservative in view of the circumstances.

The foregoing estimate of appropriation for "General expenses, Lighthouse Service," includes a provision which is submitted for "rebuilding light stations and depots and buildings connected therewith." Property of the Lighthouse Service is very much exposed to storms, and damage amounting to an average of \$100,000 per annum or upwards has been occasionally sustained from this cause. When the damage in any one locality is very extensive, it is necessary to ask Congress for a special appropriation to repair and rebuild the aids to navigation damaged or destroyed. However, it frequently happens that the rebuilding of a light station or depot or building connected therewith which has been destroyed is urgently needed, not permitting of the delay of securing a special appropriation from Congress, and also that funds may be spared from the appropriation "General expenses, Lighthouse Service," to accomplish the work. The Comptroller of the Treasury has held (decision of June 19, 1917) that the appropriation "General expenses, Lighthouse Service," does not contain authority for rebuilding such structures. It is considered to be in the interest of effectively maintaining the Lighthouse Service that provision for this purpose be made in the appropriation as recommended.

The estimate of appropriation for "General expenses, Lighthouse Service," also includes a provision for allowing commutation of rations and provisions to working parties of the Lighthouse Service in the field. The members of working parties of the Lighthouse Service are furnished their subsistence when employed away from their homes and stations, but there is no authority for commuting the allowance, it being necessary either to provide subsistence in kind or reimburse the individuals for expenditures made by them for this purpose. It will facilitate the work of subsisting field parties and reduce the amount of clerical work in district offices if authority for commuting this subsistence is granted.

Authority is also requested for the payment of travel and subsistence expenses of teachers while engaged in instructing the children of lighthouse keepers. The question of providing proper educational facilities for children at isolated light stations is a matter that has received careful attention, and in some localities, notably in the State of Maine, the State educational authorities have made provision for traveling teachers to instruct children at outlying stations, while ordinary school facilities are otherwise practically impossible. The State pays the teacher and provides the school books, and it is considered proper that the Lighthouse Service should cooperate in this meritorious work to the extent of providing for the travel and subsistence expenses of the teachers. Under the existing arrangements these expenses are paid in part by the State and by the keepers, and it is believed that a hardship is thus created on the keepers, who under their present very moderate salaries, can hardly afford such additional expenses. It may also be stated that in other Lighthouse Services, such as that of England, assistance is given toward the education of keepers' children by a so-called "educational grant," being an extra allowance of money for each child between the ages of 5 and 15 years at specified isolated stations, for expense in boarding out and educating such children.

The item of legislation recommended above for the retirement of superannuated persons has been explained in the narrative portion of this annual report, on page 28. It is estimated that approximately \$150,000 per annum would be required to provide for the compensation of persons retired under its provisions.

The above proposed legislation to provide for an increase in the ration allowance to lighthouse keepers is a restatement of the act of May 14, 1908, section 9 (35 Stat., 163), with the rate of commutation increased from 30 cents to 45 cents per ration. The sundry civil appropriation act of June 12, 1917, contains a provision for rations or commutation thereof at the rate of 45 cents per ration for warrant officers, petty officers, and other enlisted men of the Coast Guard, the rate for such commutation having been previously 30 cents per ration. The extraordinary advance in the cost of foodstuffs makes the allowance of 30 cents per ration insufficient, and it is recommended that the commutation of rations for lighthouse keepers and assistant lighthouse keepers in the Lighthouse Service be increased to 45 cents per ration, as was done for the persons mentioned in the Coast Guard.

With reference to the authority requested for the sale of lighthouse publications, it is considered that the present free system of distribution is wasteful. The Bureau, in cooperation with the Division of Publications of the Department and the Superintendent of Documents, Government Printing Office, has been endeavoring to devise some means whereby a nominal price may be placed on these publications. However, in arranging the details of this matter, business difficulties have arisen with private booksellers and agencies outside of the Government service, who decline to make the necessary returns of cash, stocks on hand, etc., unless a commission is allowed on sales, following the usual commercial practice in this respect. Recommendation for legislation to overcome this difficulty is, therefore, submitted, providing for the sale of such publications with the allowance of commissions under proper regulations. This matter has been thoroughly canvassed, and the opinion is general that a nominal charge for lighthouse publications is an economical and businesslike arrangement. The charge will not prove burdensome to those who have a genuine use for the publications and will prevent their wasteful distribution.

Authority is also requested to cover the establishment and maintenance of post-lantern lights and other aids to navigation on Lakes Union and Washington, in the State of Washington.

The completion of the Lake Washington Shipping Canal in Seattle, Wash., which was opened July 4, 1917, permits deep-sea shipping to enter Lakes Union and Washington, and it is expected that heavy tonnage will enter these inland water bodies. There are also several ferry lines now running in Lake Washington. At present the jurisdiction of the Lighthouse Service is limited to the tidal waters of Puget Sound; and Lakes Union and Washington, although connected with the sound by the canal, are not tidal waters, and, therefore, the Lighthouse Service is without authority to maintain aids to navigation thereon, its jurisdiction being restricted to tidal waters, except as otherwise specifically authorized by Congress.

It is further recommended that consideration be given to the consolidation of the four general maintenance appropriations under the single appropriation "General expenses," by naming in the consolidated general appropriation a specific amount as the limit of all salary items included therein. It is believed that this step would effect a more economical and efficient administration of the Lighthouse Service by simplification of the accounting system, and permitting the costs of work to be kept in a more systematic and comprehensive manner, showing clearly for each principal feature the relative amounts paid for salaries, materials, supplies, equipment, and other component items. Among additional advantages of consolidation of items of

general appropriation may be stated the following: (a) Laborers in charge of lights are now paid out of two different appropriations, those attending lights on rivers authorized by Congress to be lighted being paid out of general expenses, and those at other lights not on rivers being paid out of salaries of keepers; (b) commutation of rations of keepers and other employees (which may be properly considered as part of their compensation) now must be paid out of the appropriation "General expenses," while the salaries proper are paid out of the respective salary appropriations; (c) the items recommended for consolidation have natural limitations. For example, the number and average salary of keepers is limited by law. A necessary limitation is also imposed by the number of vessels in service. If such a consolidation of appropriations may be effected, it is believed that the total sum of the four general maintenance appropriations stated in these estimates, viz, \$6,729,800, may be reduced in the sum of \$25,000 to a revised total of \$6,704,800. This may be effected by reason of the fact that it is necessary to allow a small portion of each appropriation to be reserved for prevention of a deficiency prohibited by law, and if the appropriations be consolidated the amount reserved may be correspondingly reduced.

(See p. 66 for itemized estimate.)

SALARIES, KEEPERS OF LIGHTHOUSES.

For salaries of not exceeding 1,800 lighthouse and fog-signal keepers and laborers attending other lights, exclusive of post lights, \$1,080,000.

Section 4673 of the Revised Statutes of the United States is hereby amended to read as follows:

"SEC. 4673. The Secretary of Commerce is authorized to regulate the salaries of the respective keepers of lighthouses in such manner as he deems just and proper, but the whole sum allowed for such salaries shall not exceed an average of \$700 per annum to each keeper; and the authority herein granted to regulate the salaries of keepers of lighthouses shall not be abridged or limited by the provisions of section 7 of the general deficiency appropriation act approved August 26, 1912, as amended by section 4 of the legislative, executive, and judicial appropriation act approved March 4, 1913."

NOTE.—The foregoing estimates of appropriation call for an increase of \$140,000 over the appropriation of \$940,000 made for this purpose for the fiscal year 1918. It is based on proposed schedules of pay which shall provide an average salary of \$600, authorized in Revised Statutes, section 4673, to the full number of persons (1,800) provided for in the appropriation act. The present average salary is about \$555, but the present cost of all means of subsistence makes such pay inadequate, and it is considered both necessary and just to provide a higher rate of compensation for this worthy class of employees. Recommendation is also submitted for legislation to provide for an increase in the authorized average salary of lighthouse keepers from \$600 to \$700 per annum, which when granted will require additional appropriation, to be taken up at a later time.

(See p. 66 for itemized estimate.)

SALARIES, LIGHTHOUSE VESSELS.

For salaries and wages of officers and crews of light vessels and lighthouse tenders, including temporary employment when necessary, \$1,650,000.

NOTE.—The amount estimated for is \$545,350 in excess of the appropriation for the fiscal year 1918, and is caused by the unprecedented situation in shipping conditions, making it quite impossible to obtain seamen, firemen, cooks, etc., at the former recognized standard rates of pay. At the direction of the Secretary of Commerce and with the approval of the President the foregoing estimate is based on pay schedules which are in conformity with the agreement reached between the Department of Labor, the Department of Commerce, the Shipping Board, and representatives of both employees and employers. A further and fuller statement of this situation is found in this report at p. 20.

(See p. 66 for itemized estimate.)

SALARIES, LIGHTHOUSE SERVICE.

For salaries of 17 lighthouse inspectors, and of clerks and other authorized permanent employees in the district offices and depots of the Lighthouse Service, exclusive of those regularly employed in the office of the Bureau of Lighthouses, Washington, D. C., \$391,000.

NOTE.—An increase of \$11,000 over the appropriation for the fiscal year 1918 is submitted, consisting of the following:

To make up present deficiency.....	\$8,000
Additional clerks and draftsmen.....	5,000
Total.....	11,000

The item of \$5,000 is occasioned by the general growth of the Service in order that the technical and clerical work of the district offices may be dispatched promptly. About five positions at salaries ranging from \$900 to \$1,500 per annum will be thus provided for.

DETAILED ESTIMATES FOR SPECIAL WORKS, 1919.

GROUP No. 1.

Works urgently necessary for the safety or immediate needs of navigation and for the preservation of existing structures or equipment, for the full utilization of other public improvements, or for the efficient equipment of the Lighthouse Service.

No. 1. *Guantanamo, Cuba, aids to navigation.*—For dwelling for keepers of the lights in Guantanamo Bay, Cuba, and improving the lighting, \$14,000.

NOTE.—The act of July 27, 1912 (39 Stat., 239), authorized the construction of these works, but no appropriation was made therefor. The dwelling at this station was destroyed during the insurrection following the war of 1898, and since the occupation of Guantanamo by the United States the keepers have been compelled to live in a wooden shack with only three rooms and an old stable to house three keepers. The lights in charge of these three keepers are widely separated. With the installation of acetylene lights as proposed, the service of one keeper may be dispensed with. Detailed estimate:

Dwelling for two keepers.....	\$8,000
2 acetylene lights at Fisherman Point.....	2,800
2 acetylene lights at Hicacal Beach.....	2,800
Contingencies.....	400
Total.....	14,000

No. 2. *Depot for second lighthouse district.*—For constructing and equipping a lighthouse depot for the second lighthouse district, \$85,000.

NOTE.—The act of August 28, 1916 (39 Stat., 537), authorized this work, but no appropriation was made therefor. The present depot of the second district for Boston Harbor and vicinity is on Lovells Island, and is there through the courtesy of the War Department only. It is not adapted or situated for a depot where the work can be carried on expeditiously. Lighthouse tenders can not lie there nights on account of being exposed to the weather, and passing steamers make such a swash that the tender's lines are parted. The tide has been known to cover the floor of the storehouse to a depth of 1 foot. The buildings, with the exception of the oil house, are wooden, and in poor condition of repair. The wharf is also in poor condition of repair. The Treasury Department has transferred a piece of the old marine hospital property in Chelsea to the Lighthouse Service which is suitable as a site for a lighthouse depot. This property by dredging will have three berths for vessels, ample storage room for buoys, and with a brick fire-proof storehouse would make a first-class depot. Detailed estimate:

Wharf.....	\$13,576
Sea wall.....	21,606
Oil house.....	2,160
Service building.....	18,450
Depot keeper's dwelling.....	8,400
Storehouse.....	4,320
Machine and blacksmith shop.....	3,000
Buoy skid and chain platform.....	1,500
Dredging.....	9,000
Excavating and laying water pipes.....	900
Boundary fence.....	2,088
Total.....	85,000

No. 3. *Detroit, Mich., lighthouse depot.*—For improvements at Detroit, Mich., lighthouse depot, \$53,000.

NOTE.—The act of August 28, 1916 (39 Stat., 537), authorized this work, but no appropriation was made therefor. The following improvements are needed:

Addition to lamp shop: The present lamp shop is greatly overcrowded, owing to the increasing number of lighted buoys and other aids in the district, necessitating a greater and increasing quantity of parts returned for repair. Spare parts can not be accommodated but must be stored in the main storehouse, inconveniently located for the work. It is necessary to do a great deal of blacksmith repair work to moorings of buoys, etc., at the depot during the closed season of navigation, and this work must now be done in the open part of the buoy shed under very severe weather conditions during the winter or at times delayed until the severe storms are over.

Storehouse for cement and lime: Owing to the large amount of construction and repair work necessary in this district, a considerable quantity of cement and lime must be kept on hand. A small building for this storage should be provided.

Reconstruction of wharf: The wharf here has undergone for many years only such repair as necessary to render it serviceable. It is an old wooden structure on cast-iron columns standing on piles cut off about a foot below water level. It should be rebuilt and extended out to the pier line to give additional capacity. Detailed estimate:

Addition to lamp shop.....	\$10,000
Cement and lime storage.....	2,400
Reconstruction of wharf.....	40,600

Total..... 53,000

No. 4. *Hawaiian Islands lighthouse depot.*—For construction and equipment of a lighthouse depot for the nineteenth lighthouse district, \$90,000; and the Secretary

of War is hereby authorized to transfer to the Department of Commerce a portion of the Government property on Sand Island, in the Harbor of Honolulu, to be used as a site for additional facilities for said depot.

NOTE.—The act of August 28, 1916 (39 Stat., 538), authorized this work, but no appropriation was made therefor. The greatest need in this district is an adequate lighthouse depot. At present the stores are kept in two small, overcrowded, leaky storerooms on the Channel Wharf, Honolulu, where they are in danger of fire on account of proximity to fishing sampans, which are careless in the handling of gasoline. The heavy stores are kept in a large room adjoining the storage rooms occupied as a depot on Channel Wharf, lately vacated by the Territory because of the condemnation of the wharf. Buoys are kept some on Channel Wharf and some on War Department Wharf No. 1. The heavier buoys can not be kept on the Channel Wharf on account of its dilapidated condition, and when placed on the dock are exposed to the weather, and are frequently covered with coal when warships are coaling. In assembling materials for any construction work it has been the custom to collect them at the Channel Wharf, and if there is any considerable amount that wharf becomes filled up, necessitating the removal of the material on account of inconvenience to other users. Hence, the lack of a depot results in much inefficiency in collecting materials as well as inconvenience and annoyance. The fact that the temporary wharf and storehouse are in a bad state of repair, having been condemned some years ago, makes the situation very uncertain and unsatisfactory. Application for the transfer of Naval Wharf No. 3 and of a piece of land (1.2 acres) contiguous to this wharf was made to the Navy Department, but of this property only the wharf and not the land could be spared by the Navy.

As it has not been possible to acquire any land from the Navy Department adjoining Wharf No. 3, and as the act of August 28, 1916, requires that Government property under control of the Navy be utilized for this depot, recommendation is made herein for a transfer from the War Department of a portion of the Government property on Sand Island, to be used as a site for additional facilities for the proposed depot.

It is proposed to erect adequate buildings and improvements on this site for lighthouse depot purposes. Detailed estimate:

Improvements and enlargement of wharf.....	\$33,550
General storehouse.....	27,000
Buoy wharf, Sand Island.....	9,000
Oil house.....	1,500
Buoy repair and carpenter shop sheds.....	3,250
Improvement of grounds, including walks, fences, etc.....	1,000
Machine and blacksmith shop.....	7,200
Shop equipment, etc.....	3,000
Keeper's dwelling.....	4,500
Total.....	90,000

No. 5. *Light-keepers' dwellings*.—For light-keepers' dwellings and appurtenant structures, including sites therefor, within the limit of cost fixed by act approved February 26, 1907, \$75,000.

NOTE.—The act of August 28, 1916 (39 Stat., 537), authorized this work, but no appropriation was made therefor. The appropriations made March 4, 1907 (34 Stat., 1319), and May 27, 1908 (35 Stat., 334), of \$75,000 each, are now exhausted, but dwellings at a number of stations are yet needed, among which may be stated: Amelia Island, Fla.; Ano Nuevo Island, Cal.; Buffalo Breakwater, N. Y.; Charlotte, N. Y.; Diamond Head, Hawaii; Dry Tortugas, Fla.; Frankfort, Mich.; Ludington Breakwater, Mich.; Oswego Breakwater, N. Y.; Piedras Blancas, Cal.; Point Hueneme, Cal.; Point Montara, Cal.; Point Sur, Cal.; Port Eads, La.; Port San Juan, P. R.; Poverty Island, Mich.; Robinson Point, Wash.; Sand Island, Ala.; Tawas, Mich.; Toledo Harbor, Ohio; Two Harbors, Minn.; Cove Point, Md.; Point Lookout, Md.; Bodie Island, N. C.; Point Jiguero, P. R. Detailed estimate:

16 dwellings, at \$4,500.....	\$72,000
Contingencies.....	3,000
Total.....	75,000

No. 6. *Sand Island Light Station, Ala.*—For improving Sand Island Light Station, Ala., \$45,000.

NOTE.—In October, 1906, a storm destroyed the dwelling at this station, and since that time the keepers have used the tower as a dwelling. These quarters are not suitable, and it is recommended that a dwelling be erected. There is great need for a fog signal at this station, which at present has none. Fog prevails for a large portion of the winter and spring seasons, making the entrance to Mobile Bay difficult and dangerous at times. It is recommended that the station be equipped with modern fog-signal apparatus. The brick tower, which was originally erected on Sand Island, now stands surrounded by an artificial island of rock, the sand island having washed away. The station was again severely damaged by the hurricanes of 1915 and 1916 and the need of these improvements is urgent. The quantity of rock protection around the tower should be increased, about 3,000 tons of rock being required. Detailed estimate:

Riprap.....	\$26,000
Dwelling for three keepers.....	8,000
Fog-signal building.....	3,000
Fog-signal apparatus.....	8,000
Total.....	45,000

No. 7. *Gulf coast, La., light vessel*.—For constructing and equipping a light vessel for the Gulf of Mexico coast, La., or for general service, \$160,000.

NOTE.—The act of October 22, 1913 (38 Stat., 224), appropriated funds for a light vessel for Southwest Pass, but did not provide for South Pass, where there is urgent need for a similar vessel, as both passes are open and used. In the fiscal year 1917 the total value of imports and exports of the port of New Orleans was over \$400,000,000. It is proposed to construct a steel self-propelling vessel equipped with modern light and fog-signal apparatus, similar to that authorized for Southwest Pass. This is an important station, for which a lighted buoy, dependent upon weather conditions for functioning effectively, is inadequate.

No. 8. *Spectacle Reef Light Station, Mich.*—For improving Spectacle Reef Light Station, Mich., \$28,000.

NOTE.—The wall surrounding the tower and supporting the fog-signal building and boathouse is disintegrating at the water line and should be repaired before further damage occurs. It is proposed to place a belt of steel flashing around the entire pier, commencing about 4 feet below the water line and extending about 3 feet above, fastening the same by heavy expansion bolts and back filling the voids with concrete after placing the plate. The station has been carefully inspected from time to time, and the latest examinations indicate very rapid deterioration and undermining of the concrete work, and an appropriation is urgently recommended. Detailed estimate:

Steelwork in place.....	\$16,300
Concrete backing.....	11,700
Total.....	28,000

No. 9. *Depot for fifth lighthouse district.*—For enlarging and improving the lighthouse depot at Portsmouth, Va., in the fifth lighthouse district, or for establishing a new depot, and equipping the same so far as funds may permit, \$275,000.

NOTE.—The present lighthouse depot at Portsmouth, Va., is entirely inadequate to the needs of the fifth district, both in area and in water front. This is the principal depot of one of the largest lighthouse districts and is the headquarters for five tenders and two light vessels during the greater part of the year. The aggregate length of these vessels is over 1,000 feet; the total wharf frontage is only 445 feet, of which over 200 feet is in a narrow slip available for small light-draft vessels only. The operation of tenders is much hampered by this limited frontage, the delay caused by waiting to discharge or receive cargo being estimated to cost the Lighthouse Service not less than \$25,000 a year; and now that the tenders are under the jurisdiction of the Navy Department, increased facilities are an urgent military necessity. The very small area available for buoy storage necessitates much otherwise unnecessary handling of heavy buoys and appendages at large cost of time and money. The available wharf frontage of this depot should be doubled, and the area increased by from 4 to 6 acres. This may be done by purchase of a new and larger site, or by purchase of adjacent property. The present buildings are mainly antiquated wooden structures. They constitute a fire menace and should be replaced by modern fireproof buildings. Detailed estimate:

Purchase of water-front property.....	\$125,000
Construction of wharf.....	53,700
Filling, grading, and paving.....	41,250
Storehouse, coal shed, machine, blacksmith, and carpenter shops.....	32,000
Water mains, fire-protection system, and traveling electric crane.....	8,900
Lighting system and generating plant.....	5,150
Buoy skids and chain platform.....	4,000
Miscellaneous equipment.....	5,000
Total.....	275,000

No. 10. *Tender for third lighthouse district.*—For constructing, or purchasing, and equipping a lighthouse tender to replace the tender *John Rodgers*, worn out in service in the third lighthouse district, or in the Lighthouse Service generally, \$200,000.

NOTE.—There are three tenders in the third district that are old and of obsolete types, and should be replaced as soon as practicable by modern efficient vessels. These are the *Gardenia*, *John Rodgers*, and *Mistletoe*. All of these tenders to be kept in commission require repairs that are not warranted by their age and the service obtained from them. Appropriation was made in the act of June 12, 1917, for one tender for the third district, to replace the tender *Gardenia*, but this should be followed by other tenders as rapidly as funds become available. The tender *John Rodgers* is an old side-wheel steamer built in 1883 and will soon need extensive repairs, including a new boiler, and is not worth the expense. Even if the tender were in first-class condition, it would not be an efficient lighthouse tender, as this type of vessel can not be of much, if any, service in any very strong windy or rough weather or in the winter season when ice is encountered; and it is during such weather and conditions that the services of the lighthouse tenders are most needed, this being the time when trouble is encountered in maintaining buoys and other aids to navigation. Also, side-wheel vessels are difficult to handle unless under headway and are, therefore, inadaptable to lighthouse work, which requires them to be frequently worked in narrow and rocky places, in the establishment of buoys, etc. At present the tender force in the third district is taxed to the maximum, and unless a new tender is provided the Service will be seriously handicapped, for the *John Rodgers* can not be economically retained in service much longer. Another disadvantage of this tender is that it can not, owing to its insufficient size and power, handle many of the larger buoys now in use. The need of additional tenders is emphasized at the present time on account of the duty being performed for the military and naval services under national emergency. It should be replaced by a new tender before the end of the year 1918.

No. 11. *Tender for fifth lighthouse district.*—For constructing, or purchasing, and equipping a lighthouse tender to replace the tender *Jessamine*, worn out in service in the fifth lighthouse district, or in the Lighthouse Service generally, \$200,000.

NOTE.—The remarks in the item next above apply also to the tenders *Jessamine* and *Holly*, in the fifth district. These are old side-wheel steamers which should be replaced by modern efficient vessels as soon as practicable. The tender *Jessamine* is at present in need of repairs, at an expense not warranted by the age and general condition of the tender, and should be laid up and condemned before a general breakdown occurs.

No. 12. *Ambrose Channel, N. Y., lighted buoys.*—For improving the system of lighted buoys in Ambrose Channel, N. Y., \$26,000.

NOTE.—The lighting of Ambrose Channel can be improved by the use of acetylene buoys in place of the oil-gas buoys now in use. The marking of this channel was closely connected with the project for erecting Staten Island and West Bank Light Stations, N. Y., for which appropriation of \$100,000 was made in the acts of June 30, 1906 (34 Stat., 710), and March 4, 1909 (35 Stat., 971). There remains a balance of \$26,027.36 from this appropriation, which can be turned into the surplus fund, no additional outlay of funds being required to accomplish this project.

No. 13. *Joe Flogger Shoal, N. J. and Del., aids to navigation.*—For establishing gas buoys and improving the aids to navigation in the vicinity of Joe Flogger Shoal, Del., \$40,000.

NOTE.—The act of June 20, 1906 (34 Stat., 322), authorized \$75,000 for establishing a light and fog signal at or near this shoal. The act of June 30, 1906 (34 Stat., 650), appropriated \$40,000 for this purpose, and the act June 17, 1910 (36 Stat., 535), increased the limit of cost to \$105,000, but no further appropriation has been made. In view of the fact that no safe foundation could be obtained for a lighthouse in this vicinity, authorized by the act of June 20, 1906, it is thought that instead of erecting such a structure it would be better to mark this shoal by modern acetylene buoys along its entire length. The placing of gas buoys at three positions along the shoal has been authorized, but owing to lack of funds to purchase efficient gas buoys and shortage of any other equipment the shoal is poorly marked at present by only two gas buoys of an old type that is not well suited for the purpose. Modern buoys would mark this shoal in the best manner possible. Four gas buoys should be installed on the shoal, and spare gas buoys, moorings, lanterns, etc., should be provided. The Ben Davis Point Shoal Gas and Bell Buoy, 16, is an additional aid in marking the channel past Joe Flogger Shoal, and there is no spare buoy for that station. One should be provided. Standard can and nun buoys should be used in case ice makes it necessary to remove the gas buoys. If the appropriation herein recommended is made, the unexpended balance (\$39,396.79) of the appropriation of June 30, 1906, can be turned into the surplus fund, thus requiring practically no additional outlay of funds. Detailed estimate:

8 gas and bell buoys.....	\$24,000
10 can and nun buoys.....	2,500
Sinkers and moorings for buoys.....	4,700
Extra lanterns and tanks.....	8,800
Total.....	40,000

No. 14. *St. Marys River, Mich., aids to navigation.*—For improving and repairing existing aids to navigation and for establishing and moving aids as required to best serve the needs of navigation in the St. Marys River, Mich., \$80,000.

NOTE.—To properly mark the main channel through the St. Marys River between Detour and Point Iroquois, lights are maintained on some 71 distinct structures, exclusive of floating aids. Forty-five of these structures are on submarine sites, completely surrounded by water and subject to great damage by ice action at the opening of navigation each season. During the past two seasons six structures have been completely destroyed by the ice and two more so badly damaged as to require complete reconstruction. In addition, many more have been damaged to so great an extent as to make a large expenditure necessary for their proper repair. These latter structures are in such condition as to make their complete destruction probable unless repairs are made at a very early date. This work of reconstruction and repair should be undertaken at once, and in addition there are numerous improvements to aids in this locality that will materially add to their effectiveness and in many cases result in a considerable saving in maintenance cost that should be carried out at the same time that general repairs, etc., are made. This is one of the most important sections of the Great Lakes waterway, and it is essential that the aids to navigation be maintained in the highest possible state of efficiency. Estimate of cost:

Repairs to foundations of existing structures.....	\$33,500
Repairs and renewals to superstructures of existing structures.....	10,400
New buoys.....	7,500
New establishments and relocation of existing aids.....	10,700
Improvements to illuminating apparatus.....	17,900
Total.....	80,000

No. 15. *Staten Island Lighthouse Depot, N. Y.*—For extending and enlarging the machine shop at the general lighthouse depot, Tompkinsville, Staten Island, N. Y., \$30,000.

NOTE.—The present machine shop is so constructed as to be unadaptable for the work to be done in it. It will have to be extended and enlarged before it can be made an efficient and economical shop. The interior is divided into small narrow rooms, one story high, so that it is impossible to install any large machinery or a traveling crane, making it necessary to handle all work by hand. The windows are small and so arranged that the shop is dark in practically all parts except close to them. Moreover, the general construction is such that it is almost impracticable and very uneconomical to rearrange the old shop so as to be in any way convenient or efficient. The proposed improvements include an extension on the west side, three stories high, with windows properly located, having a large open room without partitions, the center of the second floor to be omitted to permit installation of traveling cranes for handling all heavy machinery, and the first floor to be so arranged that heavy machinery can be installed in such positions as to be accessible to the cranes. With this extension completed, the old shop can be used as a storehouse for castings, metals, etc., which are used in connection with the machine-shop work, these being now stored in a separate building, which is an inconvenient and uneconomical arrangement. This will also release storage space for other supplies, which is badly needed. Detailed estimate:

Alterations to present shop.....	\$4,000
New addition.....	26,000
Total.....	30,000

No. 16. *Gas buoys, fifth lighthouse district.*—For the purchase of additional gas buoys for the improvement of aids to navigation in the fifth lighthouse district, \$65,000.

NOTE.—A number of deserving projects for the establishment of additional gas buoys should be provided. Some of these have already received tentative approval, but funds have not been available for their establishment. Several of the proposed buoys have reference to river and harbor improvements already under way or provided for in the rivers and harbors bill. The great naval activity in Chesapeake Bay and tributaries increases the urgency of these projects. Detailed estimate:

Thimble Shoal Channel, Va., 4 buoys.....	\$14,400
Beaufort Entrance, N. C.....	5,200
Tail of Horseshoe, Va.....	5,200
Blue Channel, Thimble Shoal, Va.....	3,800

Section 1. The following is a list of the names of the persons who have been appointed to the various positions in the Land Office, and the date of their appointment.

THE

LAND OFFICE, has the honor to acknowledge the receipt of the letter of the 10th inst. from the Hon. the Secretary of the Interior, in relation to the appointment of a person to the position of Surveyor of the Land Office.

and in reply to inform you that the same has been forwarded to the proper authorities for their consideration.

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Very Respectfully,
 Commissioner of Land Office.

The following is a list of the names of the persons who have been appointed to the various positions in the Land Office, and the date of their appointment.

No. 21. Charleston, S. C., Lighthouse Depot.—For completing the lighthouse depot at Charleston, S. C., and for constructing an administration building for the sixth lighthouse district, \$75,000.

NOTE.—The act of October 22, 1913 (38 Stat., 244), appropriated \$125,000 toward the purchase of a site and construction of a wharf and buildings and equipment, so far as funds might permit, for a depot for the sixth district. This entire appropriation has been expended, but all the necessary facilities have not been provided. The site itself cost \$60,000 and the wharf \$46,418. Further requirements to complete the depot include dwellings for keeper and assistant keeper, who are required to live on the reservation, additional filling, water and sewer systems, walks, roads, oil house, blacksmith shop, additional equipment, etc. Without the completion of this project the district organization is inadequately equipped to efficiently perform its duties.

An office or administration building is needed at the site of the new depot, where necessary land is available. The sixth district office now occupies the "Old Exchange" building in Charleston, which, pursuant to act of Congress approved March 4, 1913 (37 Stat., 889), was on April 20, 1917, deeded by the Secretary of the Treasury to the Order of the Daughters of the American Revolution. The Government does not, therefore, own the building, but it is being occupied by the inspector's office under authority of the statute cited, providing for such occupancy until other suitable quarters are provided. More than half of the building has been vacated by the Lighthouse Service, and it is essential that other suitable quarters be provided for proper administration work of the district.

The logical location for such a building is at the depot site, which is the center of district activities.

Detailed estimate:

Administration building.....	\$30,000
Two keepers' dwellings.....	9,000
Oil house.....	5,650
Blacksmith shop.....	2,700
Concrete buoy storage.....	4,800
Walks, roads, grading, water and sewer system, etc.....	11,500
Equipment and fire protection.....	11,350
Total.....	75,000

No. 22. Depot for seventh lighthouse district.—For purchasing a site for and constructing and equipping a lighthouse depot for the seventh lighthouse district, \$175,000.

NOTE.—The Lighthouse Service storehouse, wooden smithy, and wharf are on property belonging to the Treasury Department. The wooden storehouse and wharf, which are highly inflammable, are located between the Navy coal sheds and piers A and B, one of each on each side, and are, therefore, in an unusually dirty location. The coal dust is practically always in motion, and when the coal conveyors are in operation it blows about in clouds. It finds its way into the depot keeper's quarters and into the storehouse, where thousands of dollars' worth of property is stored, which it is impossible to keep clean. These coal sheds have been erected since the storehouse was built. Furthermore, there are frequently several Navy torpedo-boat destroyers lying alongside at the Navy piers on each side of the depot wharf, which in addition to causing a great deal of dirt are a menace to the lighthouse tenders on account of collision. A new site and wharf are now urgently needed for the efficient and economical work of the district.

Detailed estimate:

Purchase of water-front property.....	\$90,000
Construction of wharf, including track.....	21,000
Bulkheading.....	8,000
Water mains.....	260
Service building, keeper's dwelling, storehouse, oil house, machine shop, carpenter shop, and blacksmith shop.....	50,040
Boundary fence, buoy skids, and chain platform.....	2,700
Shop equipment.....	3,000
Total.....	175,000

No. 23. Depot for eighth lighthouse district.—For constructing and equipping a lighthouse depot for the eighth lighthouse district, at New Orleans, La., or vicinity, \$105,000.

NOTE.—A lighthouse depot at New Orleans, La., is of great importance for the convenient and economical administration of the district. It should be at district headquarters, where supplies and materials are readily available and where shipments by rail and steamer could be received and accumulated for distribution by tender or other means at the proper time. The lamp shop should be located at this depot, as at present all intercourse with the mechanic in charge is by mail and telegraph, which is an inefficient method and the cause of numerous delays, and the present quarters are crowded, inadequate, and badly located. The stock and stores, excluding buoys and appendages, should be under the eye of the inspector at all times. The present depot at Port Eads, La., at the South Pass of the Mississippi River, is nearly 100 miles from district headquarters. The act of June 17, 1910 (36 Stat., 536), authorized the removal of the depot from Port Eads to New Orleans or vicinity and the purchase of a suitable site and erection of wharf and depot buildings, but no appropriation for the purpose has been made. A desirable site for the proposed depot would be on a portion of the Public Health Service property between State Street and Henry Clay Avenue, on the river front, provided the transfer of the same be authorized by Congress. It is believed that such transfer would not interfere with the marine hospital, and, if authorized, the amount of this estimate might be reduced by \$16,500. Detailed estimate:

Acquisition of site.....	\$16,500
Wharves on creosoted piling.....	60,000
Structural steel depot shed.....	18,000
Lamp shop, blacksmith shop, oil house, and interior finish of buildings.....	10,500
Total.....	105,000

No. 24. *Ludington, Mich., aids to navigation.*—For improving the aids to navigation and establishing new aids at Ludington, Mich., \$43,000.

NOTE.—The present location of the fog-signal station on the end of south pier subjects vessels to danger of striking the breakwater. The commerce of Ludington, which includes important car-ferry lines across Lake Michigan, is as important as any other port on the east shore of Lake Michigan, and as this port is most inadequately lighted now this improvement is considered well warranted. It is proposed to establish a main light on the outer end of the north breakwater, with fog-signal apparatus, consisting of electrically driven air compressor and compressed-air fog signal with oil engine reserve drive, and to discontinue the present steam fog signal in old wooden structure. Quarters for keepers should be erected adjacent to the light, as it is unsafe to cross the harbor during the winter when the ice is broken up by car ferries. Detailed estimate:

Foundation and tower.....	\$7,440
Fog-signal building.....	5,330
Illuminating apparatus.....	2,000
Fog-signal apparatus.....	7,230
Quarters for three keepers, including site.....	18,200
Minor lights on north and south pierheads.....	2,800
Total.....	43,000

No. 25. *Tampa Bay, Fla., aids to navigation.*—For establishing and improving aids to navigation in Tampa Bay, Fla., \$15,000.

NOTE.—Tampa is an important seaport with a large and growing commerce by sea. Owing to shallow water in Tampa Bay, deep-draft vessels can reach the city from the Gulf only by means of several comparatively narrow dredged cuts. Provision has already been made for lighting all of the important cuts excepting Cut D, for which lights should be provided as soon as practicable, as large vessels must pass through this cut in order to reach Port Tampa. Detailed estimate:

Concrete foundation.....	\$1,600
Metal-work towers.....	8,400
Illuminating apparatus.....	5,000
Total.....	15,000

No. 26. *Delaware Bay Entrance, aids to navigation.*—For improving the aids to navigation at the entrance to Delaware Bay, \$148,000.

NOTE.—In consequence of the continued erosion of the shore line in the vicinity of Cape Henlopen Light, Del., the early destruction of that light is anticipated, measures taken for the preservation of the shore line having proved unavailing. Every purpose now served by Cape Henlopen Light would be better served by the rebuilding of Harbor of Refuge Light to a height of about 140 feet. The establishment of large gas buoys is also required, one midway between, and in the line connecting Five Fathom Bank Light Vessel and Overfalls Light Vessel, one at the extreme lower and outer end of Hen and Chickens Shoal, and one in approximately the present position of Fifteen Foot Shoal Buoy. With the improvements recommended herein, including a red sector in the new Harbor of Refuge Light to cover Brown Shoal, the ultimate fate of Cape Henlopen Light will have no bearing on the practical needs of navigation in this vicinity. Detailed estimate:

Rebuilding Harbor of Refuge Light Station.....	\$127,300
3 gas and bell buoys on station.....	12,000
1 relief gas and bell buoy.....	4,000
2 extra gas tanks.....	1,200
2 extra buoy lanterns.....	2,000
Sinkers and moorings for buoys.....	1,500
Total.....	148,000

No. 27. *Goose Island Flats, N. J., Light Station.*—For establishing a light and fog signal at or near Goose Island Flats, N. J., \$140,000.

NOTE.—Vessels navigating the Delaware River are obliged to make a decided turn at this point. A temporary structure, protected by riprap, was carried away by the ice in January, 1910, although the riprap is partially in place and forms a menace to navigation unless properly marked. A buoy is now maintained at this location, but in winter it is impossible to keep it in position on account of the heavy ice. It is proposed to erect a light and fog signal, on a suitable heavy caisson foundation, close to the channel on the easterly side. Detailed estimate:

Foundation in place.....	\$65,000
Riprap protection for foundation.....	15,750
Erection of superstructure.....	48,750
Illuminating apparatus.....	3,000
Fog-signal apparatus.....	6,900
Total.....	140,000

No. 28. *Alaska, lighthouse depot.*—For a lighthouse depot and the necessary equipment, so far as funds may permit, for the sixteenth lighthouse district, \$90,000.

NOTE.—There is no lighthouse depot in Alaska, and the work of the Lighthouse Service is considerably handicapped by the lack of such facilities. Temporary quarters are now rented at \$325 per month, which would be unnecessary if proper facilities were owned by the Government. The work of the Service in Alaska is increasing materially in volume and importance, with corresponding increase in the amount of work to be handled at the depot. Present rented quarters have been outgrown, and adequate accommodations are not available for rental at reasonable figures. It is not intended at this time to erect office quarters, etc., for which further arrangements in other Federal buildings may be made in the future. Detailed estimate:

Preparation and improvement of site.....	\$6,000
Wharf.....	34,500
Warehouse.....	30,000
Other structures.....	15,400
Plant and equipment.....	4,100
Total.....	90,000

No. 29. *California and Nevada, aids to navigation.*—For the establishment of aids to navigation and improvements of existing aids in the eighteenth lighthouse district, California and Nevada, \$30,000.

NOTE.—Petitions have been received from numerous individuals, merchants, and owners and operators of barges and tugs for lighting the channel between Point San Mateo and the mouth of Alviso Slough. This waterway is the natural outlet for nearly all the produce of the extensive Santa Clara Valley, and the annual traffic, which is now reported to be upward of 50,000 tons, will be greatly increased if the channel is properly marked. The deep channel is narrow and winding, and at present there are no aids to assist mariners in keeping off the shoals at night. Much of the traffic must be carried on at night to take advantage of the tides. A petition to the Secretary of Commerce, dated November 16, 1916, asks for various lighted aids in this locality, which are urgently needed and should be established at once. Gas buoys should also be provided at Fort Rose and Point Buchan. The act of August 28, 1916 (39 Stat., 538), authorized aids to navigation on Lake Tahoe, Cal. and Nev., but no appropriation was made therefor, and funds have not been available from the general appropriations of the Lighthouse Service. Lake Tahoe has an area of approximately 200 square miles, is 21 miles long, has a mail route 70 miles long, and a great many passengers are carried on numerous steamers and launches there annually. Detailed estimate:

2 lighted buoys at \$2,000.....	\$5,200
7 lighted buoys at \$1,000.....	7,000
2 lighted buoys at \$4,500.....	9,000
Establishing 14 minor lights.....	6,300
Illuminating apparatus.....	2,500
Total.....	30,000

No. 30. *Goat Island, Cal., Lighthouse Depot.*—For repairs and improvements to Goat Island Lighthouse Depot, near San Francisco, Cal., \$55,000.

NOTE.—This depot occupies a small area gained by cutting down the steep bluff at the southeast point of Goat Island in San Francisco Bay and filling in along the shore line with the material thus secured. This area and that afforded by the present wharf are now inadequate to afford a proper disposition of the property required to be stored there. This is the only depot in the district. An additional area should be filled in with excavated material to afford room for new storehouses and additional room for storing buoys. The present storehouses are merely wooden sheds, old and poorly constructed. The present wharf should be extended to afford room for working two tenders alongside at the same time, and to permit landing and loading supplies without having to shift material already stored on the wharf. The quarters provided for the depot force are old and insanitary in arrangement and location. New quarters for the keeper and assistant keeper of the depot should be provided on higher ground and the site of the present quarters utilized for the needs of the depot proper. Detailed estimate:

Retaining wall and fill.....	\$6,000
Storehouse, reinforced concrete.....	19,000
Wharf, additional, on iron piles.....	14,000
Dwellings.....	16,000
Total.....	55,000

No. 31. *Point Pinos, Cal., Light Station.*—For improving Point Pinos Light Station, Cal., \$35,000.

NOTE.—Improvements to the combined tower and dwelling at this station are required to keep them in a serviceable condition. Fogs are of frequent occurrence at this point, and a first-class compressed-air signal, together with quarters for two additional keepers, are urgently required. Traffic into Monterey Harbor is steadily increasing and a number of large oil-carrying steamers now run regularly to this port where oil is piped from the oil fields in the interior of the State. Numerous requests have been received from shipping interests to establish a first-class fog signal at this point. The Union Oil Co. has lost one steamer at the entrance to this harbor. There is an average of 800 hours of fog per annum at this station. Detailed estimate:

Fog-signal building.....	\$4,300
Fog-signal apparatus.....	9,600
Dwelling for two keepers.....	15,600
Improvements to present station.....	5,500
Total.....	35,000

No. 32. *Michigan Island, Wis., Light Station.*—For establishing and improving aids to navigation at or near Michigan Island, Lake Superior, Wis., \$100,000.

NOTE.—The act approved May 27, 1908 (35 Stat., 332), appropriated \$2,000 to make a survey and estimate the cost and report upon the feasibility and need of establishing a light and fog signal upon Gull Island or the easterly end of Michigan Island, Apostle Group. As a result of this survey, the conclusion has been reached that the eastern end of Michigan Island is the better site. The act of June 17, 1910 (36 Stat., 536), authorized the construction of a light and fog-signal station at Michigan and Gull Islands at a cost not to exceed \$140,000, but no appropriation has been made therefor. A further study indicates that the best plan is to elevate the present light near the westerly end of Michigan Island, add a fog signal, and establish

a nonattended acetylene light on Gull Island. This arrangement would serve as a better guide to vessels passing in either direction. Detailed estimate:

Foundation, main light.....	\$6,000
Dwellings for three keepers.....	17,000
Tower.....	26,000
Minor light.....	9,495
Illuminating apparatus.....	10,000
Fog signal and hoisting apparatus.....	11,550
Fog-signal building, boathouse, and other buildings.....	11,455
Boats, tramway, walks, etc.....	5,500
Total.....	100,000

No. 33. *Kauhola Point, Hawaii, Light Station.*—For improving the light station at Kauhola Point, Hawaii, \$20,000.

NOTE.—Owing to the importance of this station, located near the northern point of the Island of Hawaii, steps have been taken to change the present lens-lantern light to a converted flashing fourth-order lens. To support this lantern and lens and to complete the improvement of this station, a new tower is necessary. A dwelling for the assistant keeper should also be provided. Detailed estimate:

75-foot cast-iron tower in place.....	\$14,750
Foundation piers for tower.....	1,000
Dwelling.....	4,000
Improvement to grounds.....	250
Total.....	20,000

No. 34. *Anacapa Island, Cal., Light Station.*—For establishing a light and fog signal at or near Anacapa Island, Cal., \$115,000.

NOTE.—Practically all coastwise vessels and a large number of those bound for Panama use the Santa Barbara Channel. The desirable course leads close to the eastern end of Anacapa Island, which is now marked by a small beacon light, not sufficiently powerful to be of service in hazy weather. The American Shipmasters' Association has presented a petition for a light and fog signal, indorsed by the San Francisco and Los Angeles chambers of commerce and important shipping interests on the Pacific coast. It is therefore recommended that a light of high candlepower and a first-class fog signal be established at this point as soon as practicable. Detailed estimate:

Light tower.....	\$16,800
Illuminating apparatus.....	6,800
Fog-signal building and apparatus.....	18,100
Two sets double quarters for four keepers.....	33,000
Oil house, outbuildings, etc.....	7,700
Wharf, launch landing, and derrick.....	9,600
Roads, grading, and fencing.....	6,000
Water supply and sewerage system.....	13,000
Launch and station boats.....	4,000
Total.....	115,000

No. 35. *Santa Barbara, Cal., Light Station.*—For improving Santa Barbara Light Station, Cal., \$28,000.

NOTE.—The station is old and the tower is too small to accommodate the revolving lens now installed in it. The tower stands one-eighth of a mile back from the point of the shore line and the light is partly obscured by trees on other properties. A new tower is required to be built farther out on the point. Coasting vessels bound north keep close inshore to avoid the prevailing northwesterly wind and sea, and a fog signal should be established here with quarters for two additional keepers. An improvement has been made in changing the light from fixed to flashing and an increase of intensity. The fog signal, as well as other improvements, and a new light tower, are necessary to render the aids efficient. Detailed estimate:

Tower, lantern, and fog-signal building.....	\$9,300
Fog-signal apparatus.....	8,100
Additional quarters.....	8,000
Improvements to present station.....	2,600
Total.....	28,000

No. 36. *Cape Spencer, Alaska, Light Station.*—For establishing a light and fog-signal station at or near Cape Spencer, Alaska, \$125,000.

NOTE.—Cape Spencer is at the entrance to Cross Sound and Icy Strait, through which pass all vessels running from Puget Sound ports to Prince William Sound, Seward, Cook Inlet, and Kodiak, excepting only occasional freighters proceeding by the outside route. With the construction of the proposed Alaskan railroad the traffic by way of Cape Spencer will be materially increased. A small unwatched light is now maintained on the cape, but it is believed that a large watched light and fog signal should be provided, especially for vessels returning from the westward, to be used as a landfall, as it is important that they be given all possible assistance, especially in thick weather. Maritime interests have urged the establishment of this aid. Detailed estimate:

Transportation and housing of materials and men.....	\$22,000
Main station structure.....	65,000
Tower superstructure and metal work.....	16,500
Minor structures.....	4,900
Illuminating apparatus.....	9,600
Fog-signal apparatus.....	7,000
Total.....	125,000

No. 37. *Staten Island, N. Y., Lighthouse Depot.*—For construction and equipping a floating drydock at the general lighthouse depot, Tompkinsville, Staten Island, N. Y., \$130,000.

NOTE.—Owing to the great number of vessels in the third lighthouse district (7 tenders and 14 light vessels) and vessels from other districts that come to the general depot for repairs, a dock of this kind is urgently needed and will result in a great saving to the Government. In the present conditions of ship-building and repair work it is very difficult to have repairs to lighthouse vessels done at all. It is proposed to construct a drydock of 2,000 tons capacity. Detailed estimate:

Drydock.....	\$120,000
Dredging.....	2,500
Mooring piling.....	7,500
Total.....	130,000

No. 38. *Portage Lake, Mich., aids to navigation.*—For establishing a light and fog-signal station upon a new site and improving aids to navigation at Portage Lake Ship Canals, Mich., \$100,000.

NOTE.—The War Department intends to remove the breakwater, and it is therefore necessary to rebuild the light and fog signal on a new site. The new light and fog signal should be established on a pier at the outer entrance, where it would be of the best service to vessels making the harbor. The construction of the station proposed will require considerable time to complete, and this project should have consideration for that reason. The harbor pier on which the present pierhead light station and fog-signal house stand, as well as the timber superstructure under the fog-signal house, are rapidly deteriorating, and it is doubtful if these structures can be maintained much longer in a safe condition unless extensive repairs are made to their foundations, which would be unnecessary in the event of the establishment of the proposed new station. Detailed estimate:

Dredging, piling, and cribwork.....	\$16,000
Stone filling and riprap work.....	12,000
Concrete base with metal flashing.....	36,000
Superstructure.....	22,500
Fog signal and lighting equipment.....	13,500
Total.....	100,000

No. 39. *Ram Island, Me., Light.*—For establishing a light on Ram Island, lower Kennebec River, Me., \$3,500.

NOTE.—The need of this light has several times been expressed by petition. Ram Island is about 5½ miles below Bath, Me.; it is a low island in the middle of the river, with a string of half-tide ledges making off on the easterly side. There is a passage on either side, and at some stages of the tide a 5-knot current exists, from which several accidents have occurred. About 300,000 tons of freight and 175,000 passengers are transported past this island annually, not including the many pleasure craft and small boats which frequent the river. It is proposed to establish an acetylene light on or near the easterly side of Ram Island.

Detailed estimate:	
Light structure, including site.....	\$1,900
Illuminating apparatus and installation.....	1,600
Total.....	3,500

No. 40. *Cape Kumukahi, Hawaii, Light.*—For establishing a light at or near Cape Kumukahi, Hawaii, \$22,000.

NOTE.—Cape Kumukahi is the easternmost cape of Hawaii. There is at present no landfall light for vessels bound to Hilo from the Panama Canal or from the southeast. It is a difficult point to round when sailing from Hilo to the south point or vice versa. A light on this point would be a great improvement to the lighting of the islands. The country in this vicinity is barren, undulating lava rock. An acetylene light is recommended, with a focal-plane height of about 150 feet, which would be visible about 20 miles. Landing from seaward at the cape is impossible at most times, and the only practical method of supplying this station would be by railroad from Hilo to Kapoho and then by wagon road 3 miles to the cape, 1½ miles of which would have to be constructed over the rock. Detailed estimate:

Road.....	\$7,100
Tower, including site and right of way.....	10,240
Illuminating apparatus.....	4,640
Total.....	22,000

No. 41. *Henderson Point, Me., Light Station.*—For establishing a light and fog signal at or near Henderson Point, Piscataqua River, Portsmouth Harbor, Me., \$4,900.

NOTE.—The need of this aid has several times been expressed by petition. It is often very difficult to locate Henderson Point at night and in thick weather; the channel is narrow and there is a strong tide at this point, where the course changes. The commercial statistics for Portsmouth Harbor indicate about 5,600 vessels arriving and departing annually, transporting about 610,000 tons of freight. It is proposed to establish an acetylene light with fog bell. Detailed estimate:

Structure, including site.....	\$2,100
Illuminating and fog-signal apparatus.....	2,800
Total.....	4,900

No. 42. *Port Real, P. R., Light Station.*—For establishing a light station at or near Port Real, P. R., \$40,000.

NOTE.—The lighthouse at Port Ferro, on the south coast of Vieques, or Crab Island, is one of the primary seacoast lights of the Porto Rican system. The light tower and the keepers' dwelling attached to it are built on top of a rocky promontory undermined for some time by the sea, and the whole structure, already dangerously cracked, is in danger of collapsing. It is urgent to rebuild a lighthouse at or near this point, as this is an important aid to the navigation from St. Thomas to Cuba and other West Indian Islands and the Caribbean Sea. A light in this vicinity is necessary for navigation, and it is proposed to dismantle the present Port Ferro Light Station and to erect a new light station at Port Real, about 3 miles westward where the aid will be more useful and on better ground than on its present location at Port Ferro, as Port Real is the most important and the best anchorage around Vieques Island. The present apparatus at Port Ferro is to be used for this new station. Detailed estimate:

Tower and dwellings for two keepers.....	\$30,000
Outbuilding and piping.....	1,500
Purchase of site.....	2,500
Roads and grounds.....	2,500
Contingencies.....	3,500
Total.....	40,000

No. 43. *Nine Mile Point, Mich., Light Station.*—For establishing a light and fog-signal station at or near Nine Mile Point, Mich., \$50,000.

NOTE.—When Forty Mile Point Light Station was established it was placed on the site designated Forty Mile Point on the county-survey charts. Sailing masters expected the station to be placed at Nine Mile Point, near the entrance to the Straits of Mackinac, but which was not so called officially then. While Nine Mile Point is within the visibility of Spectacle Reef and Poe Reef Light Vessel lights, a fog signal would be of especially great service in thick and foggy weather and during seasons when forest fires prevail. Not less than nine strandings occurred here between 1903 and 1909. In the event of establishing this station, Forty Mile Point could be made a minor light. Detailed estimate:

Tower and fog-signal building, including site.....	\$26,100
Illuminating apparatus.....	5,500
Fog-signal apparatus.....	2,000
Dwellings for three keepers.....	12,000
Outbuildings, boathouse, fences, etc.....	2,600
Boats and equipment.....	1,800
Total.....	50,000

No. 44. *Caribbean Sea, aids to navigation.*—For establishing aids to navigation in the Caribbean Sea along routes leading to the Panama Canal, \$75,000.

NOTE.—The need for aids to navigation in the Caribbean Sea has become more urgent with the increase of traffic due to the Panama Canal, and such aids have been requested by the steamship companies using these routes. It is proposed to establish gas and whistling buoys at Farrall Rock (Gorda Bank), Southwest Cay (Serrana Bank), Formigas Bank, and Blower Rock (Pedro Bank), an unwatched acetylene light on the south end of Old Providence Island, another unwatched light at Courtown Cays and a first-class can buoy to mark the north end shoal of Old Providence Island. Detailed estimate:

4 gas and whistling buoys with moorings, etc., on station.....	\$26,000
2 gas and whistling buoys with moorings, etc., relief.....	13,000
1 first-class can tall-type buoy.....	1,000
2 towers in place.....	30,000
Illuminating apparatus.....	5,000
Total.....	75,000

No. 45. *Galveston Jetty Light Station, Tex.*—For improving Galveston Jetty Light Station, Tex., \$8,500.

NOTE.—The appropriation for this station is insufficient for the purchase and installation of a sufficiently powerful fog signal. It is recommended that a compressed-air fog signal be installed as soon as funds permit. Detailed estimate:

Compressors.....	\$5,000
Fog-signal apparatus.....	2,000
Piping and installation.....	1,500
Total.....	8,500

No. 46. *Grays Harbor Light Station, Wash.*—For improving Grays Harbor Light Station, Wash., \$15,000.

NOTE.—The present steam fog-signal plant at this station is located in a frame building. Both the machinery and building are quite old and in poor condition. It is proposed to construct a new fireproof building and install an electrically operated siren as soon as funds permit. Detailed estimate:

Fog-signal building.....	\$6,500
Purchase and installation of apparatus.....	8,500
Total.....	15,000

Total, group No. 2, \$1,747,900 (not included in total of estimates).

DESCRIPTIONS OF NEW WORKS COMPLETED.

The following are brief technical descriptions of important lighthouse works completed since the end of the fiscal year 1916:

OIL HOUSES FOR LIGHT STATIONS.

Purpose.—Isolated fireproof structures for the storage of kerosene and other inflammable supplies were erected at two light stations, in order to lessen the hazard of fire at such stations. These houses were constructed under allotments made from the balances existing under appropriations of \$10,000 each by the acts of May 27, 1908, March 4, 1909, and June 25, 1910. The unobligated balance of these appropriations is now \$255.10. Details regarding each are shown in the following table:

District.	Station.	Site and structure.	Completed.	Cost.
3d.....	Point Judith, N. Y.....	Concrete house 13 by 15 feet.....	July, 1916	\$521
7th.....	Carysfort Reef, Fla.....	250-gallon steel tank.....	June, 1917	188

WEST BANK LIGHT STATION, N. Y.

Purpose.—To reinforce the foundation of the tower, which was badly broken and deteriorated below low water.

Site.—West Bank Light Station is located on the west prolongation of axis of outer section of Ambrose Channel, New York Lower Bay, N. Y. The depth of water at this site is about 22 feet.

Work accomplished.—Installed riprap bulkhead around the base of tower and filled in between foundation and breakwater with small stones tightly packed.

Cost.—The work was done under allotments made from the appropriation "General expenses, Lighthouse Service." The total cost was \$10,913.07. The work was done during July, 1916.

OVERFALLS LIGHT VESSEL "NO. 69."

Purpose.—To strengthen vessel, the original iron bolt fastenings having corroded away to the extent that vessel was becoming unsafe.

Work accomplished.—The work consisted of the removal of the wood sheathing, refastening of hull planking, repairing of the keel plate, and the furnishing and installation of new sheathing metal. There were also built and installed 12 water tanks, and the vessel thoroughly overhauled and repaired throughout.

Cost.—The work was commenced in January, 1916, and completed in December, 1916. The total cost was \$23,876.22.

TENDER "LARKSPUR."

Purpose.—To repair, rearrange, and strengthen vessel, also to increase the efficiency of and enable vessel to cope with present day buoy work.

Work accomplished.—Installed new boilers, new auxiliary machinery, new main deck, repaired and strengthened hull, installed more powerful derrick and hoisting engine, and rearranged quarters, etc.

Cost.—The work was started in September, 1915, and completed in June, 1917. The total cost was \$84,777.93.

STATEN ISLAND LIGHTHOUSE DEPOT, N. Y. (CARPENTER SHOP).

Purpose.—The building which had previously been used as a carpenter shop was an old building, badly constructed, and a menace in case of fire. It was also poorly adapted to carry on the required carpenter work and was undesirable from every standpoint.

Site.—The site is on the southeastern portion of the reservation, adjacent to the depot basin, and so located that the work can be carried on efficiently.

Structure.—The structure consists of a rectangular, three-story, reinforced-concrete building with flat slab floors, without beams or girders, supported on piers, the outside piers resting on spread footings. The exterior wall surfaces between piers, except for narrow concrete panels above and below the windows, are filled with glass in steel sash. The stairs are of reinforced concrete, and the building is equipped with a complete plumbing outfit. The roof is of the same construction as the floors, except that it is covered with tar and gravel roofing material. The dimensions of the building are 60 by 121½ feet by approximately 40 feet high.

Cost.—The building was constructed under the act of August 1, 1914, appropriating \$23,000. It was constructed under two different contracts with the same contractor. Work was commenced in August, 1915, and completed in January, 1917. The total cost was \$21,855.49.

DEPOT FOR THE SIXTH LIGHTHOUSE DISTRICT.

Purpose.—To meet the demands for increased facilities for the storage of supplies, handling buoys, to provide adequate docking conveniences for tenders, and to bring the depot into closer touch with the district office.

Site.—The depot is situated at the west end of Tradd Street, Charleston, S. C., with a frontage of about 680 feet on the Ashley River. Total area of site about 4.7 acres.

Structures.—Consist of a creosoted-timber wharf 511 feet 7 inches by 48 feet; a three-story storehouse 110 feet 6 inches by 91 feet 2 inches, in which are located steel storage racks for supplies; the depot keeper's office, lamp shop, and carpenter shop. Track facilities run through the ground floor to the outer end of the wharf.

At the present time the keeper's dwelling is an old wooden house that was purchased with the site. The site is fenced in on two sides with a high wooden (cypress) fence with reinforced-concrete posts. The front fence, on Tradd Street, is of ornamental brick and wrought-iron construction.

Cost.—The depot was constructed under the act of October 22, 1913, appropriating \$125,000. The amount expended to June 30, 1917, was \$125,000.

The work was accomplished by contract and hired labor and occupied for lighthouse purposes August 1, 1916.

DRY TORTUGAS LIGHT STATION, FLA. (WHARF).

Purpose.—This new wharf was built to replace the old wharf destroyed by storm of July, 1916.

Site.—On the eastern side of the lighthouse reservation on Loggerhead Key, Dry Tortugas, Fla.

Structure.—This wharf is 140 feet long by 10 feet broad, with landing platform at head of dock 20 feet long by 3 feet broad. Structure consists of 28 wrought-iron piles with cast-iron caps, wooden girders, stringers, and decking; support for landing platform made of angle iron.

Cost.—This wharf was built under an allotment of \$2,800 made from the act of September 8, 1916. The work was completed in May, 1917, by hired labor. Total cost of work to June 30, 1917, \$2,631.19.

RELIEF LIGHT VESSEL "NO. 82."

Purpose.—This light vessel, reported in previous annual reports as being sunk and raised, has been reconstructed throughout to strengthen and make the vessel more seaworthy and increase its efficiency for use as a relief vessel on the Great Lakes.

Work accomplished.—The hull thoroughly repaired; main and auxiliary machinery put in efficient condition; new steel deck house, including rearrangement of quarters; pilot house and lantern mast installed, replacing those formerly constructed of wood; new acetylene-gas lighting apparatus of greater power installed; fog-signal apparatus

reconstructed to meet the characteristic of all lake vessels; and new submarine bell installed.

Cost.—The work of reconstructing the vessel was started in December, 1915, and completed the latter part of July, 1916, at a total cost of \$44,012.

AIDS TO NAVIGATION, MANISTIQUE, MICH.

Purpose.—On the completion of the east and west breakwaters by the United States Engineers, the aids described below were established for the purpose of guiding an important car-ferry line and other lake commerce to the harbor entrance through the crooked channel at the mouth of Manistique River. The aids were placed in commission as they were completed, the entire system being in service by August 17, 1916.

Sites.—Manistique Light Station is located near the outer end of the east breakwater, about 1,800 feet from the inner end, where the switch house is located, which is connected with the light station by an electric cable placed along the top of the breakwater. The keeper's dwelling is located on a lot purchased for the purpose, at the city limits, about 1,200 feet northeast of the inner end of the breakwater. The switch house and dwelling are connected by an electric transmission and control pole line across open shore property recently taken over by the city for park purposes.

West breakwater light is located on the outer end of the west breakwater about 1,400 feet from its inner end.

West pier light is located on the outer end of the timber crib forming the west pier about 350 feet from its inner end.

Structures.—Manistique Light and Fog Signal: The subfoundation for this tower consists of a timber crib built by the United States Engineers. It rests on bedrock and supports a concrete superstructure, and this in turn supports a rectangular concrete block, 20 by 25 feet in plan and 6 feet high, forming the immediate foundation for the tower. The top of this block is 10 feet above lake level. The tower is of riveted steel plates and angles, square in plan and pyramidal in shape, three and one-half stories high, and supports a cast-iron deck and an old-style fourth-order vertical bar lantern, whose focal plane is about 40 feet above the top of the block. The main floor is 5½ feet above the block and contains the machinery for the fog signal. Below it and partly within the block is a basement room for storage purposes. Above it the second floor supports the air tanks and the third floor the diaphone and attachments. All floors are of reinforced concrete, and the basement and power room are lined with surfaced cement with air spaces next to the steel plates. The two upper rooms are not lined. The switch house mentioned above is a small, round, steel building with a cement floor and houses the switches and remote control magnetic switches. A transformer (2,200 to 440 volts) is located on a pole alongside the house.

West breakwater light: The subfoundation for the tower is similar to that of the main light station and supports a pyramidal concrete block, 13 by 14 feet in plan at the base and 6 feet high, whose top is 10 feet above lake level. This block supports a standard 25-foot steel skeleton tower and accumulator house. A lens lantern is supported by the tower whose focal plane is about 26 feet above the top of the block.

West pier: The subfoundation for this light is a timber crib built by the United States Engineers. It supports a wooden post provided with pulley blocks and tackle for hoisting a post lantern. A wooden lamp house is located at the foot of the mast.

Illuminating apparatus.—Manistique Light and Fog Signal Station: The illuminating apparatus consists of a 300-millimeter lens lantern, showing a fixed red light of 340 candles. The focal plane is 50 feet above lake level, and the light is visible 13 miles in clear weather. The light is furnished by a 200-watt gas-filled tungsten-filament electric lamp with a red screen, and there is a reserve lamp for emergency use in case the main lamp burns out. It is controlled by a push button in the dwelling. The voltage is 110, obtained, from 440 volts, by a transformer in the tower previously noted.

West breakwater: The illuminating apparatus consists of a 300-millimeter lens lantern, showing a flashing white light of 120 candles every three seconds. The focal plane is 36 feet above lake level, and the light is visible 10 miles in clear weather. The light is furnished by a three-fourths foot burner using compressed acetylene gas, which is controlled by a flashing mechanism and sun valve.

West pier light: The illuminating apparatus consists of a type B post lantern, showing a fixed white light of 60 candles. The focal plane is 26 feet above lake level, and the light is visible 10 miles in clear weather. The light is furnished by a double-wick kerosene lamp.

Fog signal.—Manistique Light and Fog Signal Station: The fog signal consists of a type F diaphone using compressed air, and the characteristic is a blast of 2 seconds duration followed by a silent interval of 18 seconds. The horn is located about 42 feet

above lake level. The compressing plant consists of a single double-cylinder air compressor of 110 cubic feet capacity at 30 pounds per square inch per minute and driven by a 15-horsepower electric motor operating on an alternating current of 440 volts. The apparatus is controlled by a push button in the dwelling.

Quarters.—The quarters for the two keepers who attend these aids consist of a two-story and attic dwelling, one set of quarters being over the other. The building is constructed of hollow tile, with stucco exterior, on a concrete foundation and has an asphalt shingle roof. It is heated by hot water, lighted by electricity, and provided with city water and a sewerage system. The basement contains a general boiler room and coal bin for the heating plant and separate coal bins, vegetable rooms, and cellar spaces for each keeper. Each set of quarters consists of a living room, dining room, kitchen, pantry, three bedrooms, bathroom, closets and lockers and an outside porch. There are separate front entrances for each keeper and a general rear entrance. The attic contains large storage spaces for both keepers.

Cost.—These aids were established under the act approved October 22, 1913, appropriating \$20,000. The total cost of the work was \$19,999.96. The steel structures were built in the shops, materials were purchased under informal contracts, and the field work was done by hired labor. The work was commenced in December, 1913, and was completed in August, 1916.

AIDS TO NAVIGATION, SHEBOYGAN, WIS.

Purpose.—Upon the completion of the project for improving the harbor at Sheboygan, Wis., by the United States Engineers, which consisted in the removal of the north pier and the construction of a north breakwater to form a stilling basin at the harbor entrance, it became necessary to rearrange and relocate the lights marking the entrance. The entire system was in commission November 24, 1916.

Sites.—Sheboygan Breakwater Light Station is located on the southeast end of the new north breakwater, about 4,000 feet from the inner end, at its junction with the shore, where the power house for the fog signal is located, which is connected with the light station by a line of pipe conveying compressed air to the fog signal and a lead-covered electric cable for conveying the current controlling the characteristic valve of the siren.

Sheboygan south pierhead is located on the outer end of the south pier.

Sheboygan north pierhead is located on the outer end of the stub of the north pier.

Structures.—Sheboygan breakwater: The subfoundation for this tower consists of a timber crib built by the United States Engineers. It rests on the lake bottom and is capped by a concrete superstructure supporting a rectangular concrete block, 25 by 30 feet in plan and 6 feet high, forming the foundation. The top of the block is 10 feet above lake level. The tower is of riveted steel plates and angles, circular in plan, conical in shape, and supports a cast-iron deck and fourth-order helical bar lantern, whose focal plane is 45 feet above the top of the block. This tower formerly stood on the old north pier and was moved to its present location, without dismantling, by means of a scow. The power house for the fog signal mentioned above is built of hollow tile, with roughcast stucco finish outside and smooth cement stucco finish inside. It stands on a reinforced-concrete slab supported by the reinforced-concrete walls of a basement, and this in turn is supported by the piles and cribwork of the breakwater. The roof is of wooden framework and asphalt shingles. There are two rooms in the basement and one on the main floor. It is heated by a hot-air furnace and provided with city water and sanitary arrangements.

Sheboygan south pierhead: The subfoundation for this tower consists of the timber crib built by the United States Engineers. It supports within it a reinforced-concrete foundation for the tower consisting of four piers and a slab whose top is 7 feet above lake level. The slab supports a standard 31-foot steel skeleton tower and accumulator house. The focal plane of the lens lantern supported by the tower is about 33 feet above the top of the block.

Sheboygan north pierhead: The foundation for this light consists of the cribwork of the old north pier and supports an iron post from which a post lantern is exhibited.

Illuminating apparatus.—Sheboygan breakwater: The illuminating apparatus consists of a fifth-order lens showing a flashing red light of 160 candles every 4 seconds. The focal plane is about 55 feet above lake level, and the light is visible 10 miles in clear weather. The light is furnished by a 1-foot burner using compressed acetylene gas, controlled by a flashing mechanism and a sun valve.

Sheboygan south pier: The illuminating apparatus consists of a 200-millimeter lens lantern showing a flashing white light of 70 candles every 3 seconds. The focal plane is about 40 feet above lake level, and the light is visible 8 miles in clear weather. The

light is furnished by a one-half foot burner using compressed acetylene gas, controlled by a flashing mechanism.

Sheboygan north pier: The illuminating apparatus consists of a type B post lantern showing a fixed red light of 20 candles. The focal plane is 31 feet above lake level. The light is furnished by a double-wick kerosene lamp.

Fog signal.—*Sheboygan breakwater:* The fog signal consists of a standard 6-inch automatic siren using compressed air, and the characteristic is a blast of 3 seconds duration followed by a silent interval of 27 seconds. The 3½-inch compound whistle valve governing the siren is operated by an electric solenoid supplied with current in the manner mentioned above. The horn is placed in the tower about 44 feet above lake level. The three air tanks are located on the first and second floors and are connected with the power house near the shore end of the breakwater by a pipe line about 4,000 feet long. The compressing plant in the power house consists of an air compressor of 145 cubic feet per minute capacity at 100 pounds per square inch, belt driven by a 25-horsepower electric motor operating on an alternating current of 220 volts. For emergency use an oil-engine-driven air compressor is installed in the same room. For cooling the air and exhausting its moisture a system of cooling pipes, separator tanks, etc., are installed in the basement and on the outside north wall of the power house, and a valve for reducing the air pressure is located at the entry into the pipe line.

Quarters.—The quarters for the two keepers who attend these aids consist of a double two-story dwelling, with apartments for three keepers, and are located on shore near the inner end of the north pierhead. It was completed in October, 1911, at a cost of \$6,000, which has not been included in the cost below. The structure is of brick on a concrete foundation, with cedar-shingled roof. It is heated by hot air, lighted by gas, and provided with city water and a sewerage system. Facing the front, the left-hand side of the house contains the keeper's quarters, consisting of one large room in the basement; kitchen, pantry, dining room, and parlor on the first floor; and three bedrooms with closets and a bathroom on the second floor. The right-hand side contains one set of quarters over the other for the assistants. Each assistant has a separate cellar space and a combined kitchen and living room, a pantry, bedroom or sitting room, a bedroom, and a bathroom on one floor.

Cost.—The four aids mentioned (omitting the dwelling, which was built from a special appropriation) were relocated and established under allotments made from the appropriation "General expenses, Lighthouse Service," for 1915, 1916, and 1917. The total cost was \$22,633.95. The steelwork, machinery, and material were purchased under informal contracts and the field work carried out by hired labor. The work was started in March, 1915, and completed in November, 1916.

AIDS TO NAVIGATION, ALASKA.

Purpose.—To meet the demands of the increasing commerce and to continue the work of establishing efficient aids to navigation, two acetylene lights and six gas buoys were established at various points in Alaskan waters. Data relative to these lights are shown in the table following.

Fog signals.—One gas buoy has a bell sounded by the action of the sea.

Quarters.—There are no quarters. These lights are all of the unwatched type, using compressed acetylene in acetone, supplied from batteries of steel cylinders, which contain a sufficient supply of gas to operate the light continuously between visits of the lighthouse tender.

Cost.—The appropriation of 1911 has been expended, and to June 30, 1917, the total expenditure from the appropriation of August 1, 1914, was \$59,695.

Name of light.	Locality.	Structure.	Top of lantern above ground, in feet.	Illuminating apparatus.	Characteristic.	Intensity of light, in candles.	Focal plane above mean high water, in feet.	Miles seen.	Approximate cost.	Date of establishment.
Hanin Rocks.....	Kodiak Harbor.....	Small white wooden house.	10	Acetylene lens lantern.	Group flashing white (flash 0.3 sec., eclipse 0.9 sec.; flash 0.3 sec., eclipse 4.5 sec.).	310	43	11	\$2,885	July 27, 1916
Susitna River.....	Cook Inlet.....	do.....	10	do.....	Flashing white (flash 0.3 sec., eclipse 2.7 sec.).	130	13	9	451	Aug. 12, 1916
Channel Rock Gas Buoy, 2.	Sitka Sound.....	Type L gas buoy.....		do.....	do.....	70	12	7	1,490	Feb. 26, 1917
North Rock Shoal Gas Buoy, 2.	Orca Inlet.....	do.....		do.....	Flashing red (flash 0.3 sec., eclipse 2.7 sec.).	40	12	6	2,706	Aug. 31, 1917
Orca Inlet Gas Buoy, 6.	do.....	do.....		do.....	Flashing white (flash 0.3 sec., eclipse 2.7 sec.).	130	12	9	2,706	Do.
Potter Rock Gas Buoy, HS.	Tongass Narrows.....	do.....		do.....	Flashing white (flash 0.4 sec., eclipse 1.6 sec.).	70	12	7	2,709	Sept. 21, 1916
Poundstone Rock Gas and Bell Buoy, 1.	Lynn Canal.....	do.....		do.....	Flashing white (flash 0.3 sec., eclipse 2.7 sec.).	130	12	9	2,886	Oct. 15, 1916
Reef Island Reef Gas Buoy, 2.	Prince William Sound.....	do.....		do.....	Flashing white (flash 1 sec., eclipse 9 sec.).	130	12	9	2,709	Sept. 1, 1916

CAPE ST. ELIAS LIGHT STATION, ALASKA.

Purpose.—To identify Cape St. Elias, an important landfall for mariners navigating the Alaskan coast. All vessels, whether plying between southeastern and southwestern Alaska or bound direct between Prince William Sound and ports of the Pacific Coast States, make Cape St. Elias. The light was established September 6, 1916, and the fog signal went into commission January 30, 1917.

Site.—The station is located on the southern end of Kayak Island, which extends 25 miles out into the Pacific Ocean, south of Controller Bay, terminating in a bold promontory known as Cape St. Elias, near which stands Pinnacle Rock. Dangerous reefs extend some 3 miles off the cape. The building, consisting of a combined tower and fog-signal building, storage house, dwelling, and hoist house, stands on the slope westerly from the promontory, and the boathouse and shop are located at the foot of the bluff at the head of the tramway to both east and west beaches. The foundations of all structures are on a hardpan formation, and the tower stands on a terrace whose grade line is about 42½ feet above mean high water.

Structures.—The tower is constructed of reinforced concrete. It is square in plan with vertical walls, supports a square cast-iron watch-room gallery with railing and cylindrical watch room, the latter supporting a second-order cylindrical helical bar lantern, whose focal plane is about 42½ feet above grade line. There is a room on the first floor, and above it there is a service room, then the watch room and lantern mentioned above. A clock-weight shaft runs through the center of the tower from a pit in the first floor to the watch-room floor above.

The fog-signal building is connected with the tower at its southwest corner, and is also constructed of reinforced concrete. It contains one room. The concrete floor is provided with covered trenches for oil, water, and exhaust piping and foundation for the machinery. The walls are lined with hollow tile and plastered, and the roof trusses are of steel covered with asbestos slates. The storage building is constructed entirely of reinforced concrete, including the roofs and floors. It projects from the north side of the fog-signal building and is in two sections and on two different levels. The section connected with the fog-signal building contains a coal bin and various apparatus connected with the oil, water, and cooling systems. The other section contains in the lower story two water-storage cisterns and a filter cistern for the rain water from roofs of fog-signal building and dwelling and in the upper story steel tanks for the fuel oil and kerosene, and storage for gasolene, lubricating oils, etc. The hoist and boat houses are of cement-sand brick manufactured at the site, and the roof trusses are of wood covered with asbestos slates. The hoist house contains two rooms. One contains a 9-horsepower oil engine for pulling the car up the tramway from the boathouse to the storage house, and the other room is for the storage of paints, oils, etc. The boathouse contains one room, in which is located a 6-horsepower oil engine for pulling the car up the tramways from the east and west beaches and storage space for three dories. A carpenter shop is located in one end of the room.

Illuminating apparatus.—The illuminating apparatus consists of a third-order flashing lens of two grouped panels, each made up of 7 refracting and 10 upper and 4 lower reflecting prisms, rotating on a mercury float driven by clockwork, and showing two white flashes every 20 seconds. The intensity of the light is estimated at 300,000 candles, the focal plane is 85 feet above mean high water, and the light is visible 15 nautical miles in clear weather. A 55-millimeter 3-mantle, triple-tank, type B, incandescent oil lamp furnishes the light. The kerosene is pumped from the storage building to the service room by a self-measuring oil pump.

Fog signal.—This consists of duplicate 6-inch automatic sirens blown by compressed air at 45 pounds pressure per square inch and using double-mouth copper trumpets located 57 feet above mean high water. The characteristic is a double blast every 60 seconds. The compressing plant consists of two 18-horsepower direct-connected, tandem, crude-oil engines and compressors, each having a capacity of 108 cubic feet of free air per minute at 60 pounds pressure. There are two air receivers or tanks, and the supply pipe from the low-pressure tank passes through a preheater to the sirens.

Quarters.—The quarters for the keepers in charge of this station consist of a single two-story dwelling constructed of cement-sand brick manufactured at the site, and the roof trusses are of wood covered with asbestos slates. The basement contains three rooms, for the hot water heating plant, coal, and the stores and provisions. The first story contains an entrance hall, kitchen, pantry, dining room, office, and a spare room for visiting employees. The second story contains four bedrooms with closets, hall, and bathroom. In the attic are five tanks for the water supply to dwelling and fog-signal, in addition to those in the storage building. Supplies are landed by boat from the tender on either the east or west beaches and thence by shore tramways to the station.

Cost.—The station was established under the act approved October 22, 1913, appropriating \$115,000. The amount expended to June 30, 1917, was \$113,653.64. The work was carried out by the purchase of materials and hired labor. The metal work of the upper part of the tower was built under contract. Construction began June 1, 1915, and was virtually completed October 1, 1916.

LIGHTHOUSE TENDER "CEDAR."

Purpose.—The tender *Cedar* was built for general lighthouse service as a seagoing tender in the waters of Alaska, sixteenth district.

Structure.—This tender is 200 feet 8 inches over all, with a molded beam of 36 feet and a displacement of 1,800 tons when floating at a mean draft of 13 feet in salt water. The entire vessel throughout is built of steel, with seven water-tight bulkheads. The hull is constructed with a double bottom throughout for carrying water and fuel oil. Fuel-oil tanks built structurally are also fitted. All deck and pilot houses are of steel. A steel derrick mast, with reinforced wooden boom, complete with steel-wire rope, falls, and blocks, operated by a steam hoisting engine of the four-drum type, is fitted at the after end of the buoy deck. A steam anchor windlass is fitted under the fore-castle deck forward with a capstan above the deck. A steam hoister is also fitted on the upper deck aft of the steel mainmast.

Machinery.—The propelling machinery consists of one triple-expansion surface-condensing engine of the vertical inverted type, having cylinders 20, 32½, and 55 inches in diameter by 39 inch stroke, driving a right-handed, four-blade, cast-steel, built-up propeller, 11 feet 6 inches in diameter by 16 feet pitch, and supplied with steam at 190 pounds per square inch by two three-furnace Scotch-type boilers using oil as fuel, having a total heating surface of 4,760 square feet. The tender is fitted throughout with all modern appliances, including sanitary plumbing and fixtures, drainage system, fire main, steam-smothering fire system, hot and cold fresh-water system, oil-burning system operating main boilers and galley range, electric lighting system, and radio apparatus. Foundations have also been provided for four 6-pounder guns.

Quarters.—The complement of the tender is 7 officers and 22 men. The deck officers' and radio operator's quarters are located on the upper deck under and aft of the pilot house. The inspector's quarters are located on the upper deck aft. Quarters for the superintendent and engineers are located on the main deck aft, as are also the officers' mess room, galley, storerooms, and five spare staterooms for official passengers. Quarters for 16 men are located forward under the main deck. The cargo holds are located forward under the buoy or main deck, also aft under the main deck. The forward hold is subdivided in way of the main hatch by a vertical water-tight bulkhead, the forward space being a deep hold and the after space divided into an upper and lower hold by a lower deck, all spaces being accessible through the main-deck hatch. The capacity of the cargo holds are: Forward deep hold, No. 1, 15,196 cubic feet; forward upper hold, No. 2, 8,111 cubic feet; forward lower hold, No. 3, 8,210 cubic feet; after hold, No. 4, 8,381 cubic feet.

Cost.—This tender was constructed under the act of January 15, 1915, appropriating \$250,000. The vessel was built under contract at Long Beach, Cal., and the cost was \$248,188.88. Construction was commenced May 4, 1915, and the vessel was completed and placed in commission June 30, 1917, at Long Beach, Cal.

LIGHTHOUSE TENDER "PALMETTO."

Purpose.—The tender *Palmetto* was built for general lighthouse service in the inland waterways, including the rivers, bays, and tributaries of North and South Carolina, Georgia, and Florida, sixth district.

Structure.—This tender is 90 feet over all, with a molded beam of 22 feet and a displacement of 170 tons when floating at a mean draft of 4 feet in salt water. It is a single-deck vessel constructed of steel, with deck houses and pilot house of wood. A wooden derrick mast and boom, fitted with steel-wire falls and blocks complete, with a hoister operated by a gasoline engine, are located at the after end of the buoy deck.

Machinery.—The propelling machinery consists of two four-cylinder, internal-combustion engines, operating on gasoline, with cylinders 8 inches in diameter by 10-inch stroke. Each engine drives a three-blade bronze propeller 38 inches in diameter by 38-inch pitch. Both propellers turn outboard from the top, the starboard propeller being right handed and the port left handed. The tender is fitted throughout with a sanitary plumbing system, drainage, and compressed-air system operating the flushing, fresh-water, and gasoline tanks, but has no electric lighting system.

Quarters.—The complement of the tender is three officers and eight men. The deck officers' and inspector's quarters are located on the upper deck aft of the pilot

house. The officers' mess room, galley, engineer's and assistant engineer's room, crew's quarters, work room, bathrooms, and ice box are located in the main-deck house. The cargo hold is located under the buoy deck forward and has a capacity of 4,972 cubic feet.

Cost.—The tender was constructed under the acts of May 27, 1908, and March 4, 1909, appropriating \$200,000 for one tender, and the acts of July 27, 1912, and March 3, 1915, authorizing the use of this amount for the construction of two or more tenders for general service. The vessel was built under contract at Jacksonville, Fla., and the cost was \$27,687.20. Construction was commenced September 3, 1915, and the vessel completed and placed in commission March 19, 1917, at Jacksonville, Fla.

LIGHTHOUSE TENDER "ROSE."

Purpose.—The tender *Rose* was built for general lighthouse service in the small harbors and inside waters of the coast of Oregon and Washington, seventeenth district.

Structure.—This tender is 127 feet 6 inches over all, with a molded beam of 24 feet 6 inches and a displacement of 567 tons when floating at a mean draft of 9 feet 4 inches in salt water. It is a single-deck vessel, constructed of steel throughout with the exception of the upper and forecastle decks and upper-deck houses and pilot house, which are of wood. A wooden derrick mast and boom, complete with hoisting engine and wire-rope gear, are located at the after end of the forecastle deck, the hoisting engine being in the fore hold.

Machinery.—The propelling machinery consists of two triple-expansion inverted direct-acting engines having cylinders 8, 13, and 21 inches in diameter with a common stroke of 16 inches, fitted with the Stevenson link-motion reverse gear, each driving a four-blade cast-iron propeller 5 feet 6 inches in diameter by 7 feet 11 inches pitch, the starboard propeller being right handed and the port left handed, the propellers both turning outward from the top. Steam is supplied at a working pressure of 200 pounds per square inch by two Army water-tube boilers using oil as fuel, having a total heating surface of 3,210 square feet.

The tender is completely fitted throughout with all modern appliances, including sanitary plumbing and fixtures, heating and drainage systems, and electric lighting system.

Quarters.—The complement of the tender is 4 officers and 16 men. The officers' quarters are located in the main-deck house aft and the upper-deck house aft of the pilot house. The officers' mess room, galley, storerooms, etc., are located on the main deck, as is also the inspector's and superintendent's staterooms and bathroom. Quarters for the crew are located forward under the forecastle deck. The cargo hold is located under the buoy deck and has a capacity of 5,320 cubic feet.

Cost.—This tender was constructed under the acts of May 27, 1908, and March 4, 1909, appropriating \$200,000 for one tender, and the act of July 27, 1912, authorizing the use of this amount for the construction of two tenders for general service. The vessel was built under contract at Seattle, Wash., and the cost was \$92,135. Construction was commenced on November 6, 1914, and the vessel completed and placed in commission August 8, 1916, at Seattle, Wash.

LIGHT VESSEL "NO. 101."

Purpose.—Light vessel No. 101, on October 4, 1916, was placed on station off Cape Charles, Va., entrance to Chesapeake Bay, in the fifth district.

Structure.—The vessel is 101 feet 10 inches over all, with a molded beam of 25 feet and a displacement of 360 tons when floating at a mean draft of 11 feet 4 inches in salt water. The entire vessel is built of steel, including the bulkheads and doors forming the main-deck quarters, the upper deck throughout being of the turtle-back type. A steel pilot house and chart house and a trunk forming a ventilator and light shaft over the engine room are located on the upper deck. One steel lantern mast, of a diameter sufficient to contain a ladder giving access to the lantern, is fitted. Modern devices have been fitted for the stowage of anchors and boats. A small wooden jigger mast and sail, for steadying the vessel at anchor, is fitted on the upper deck aft.

Illuminating apparatus.—The signal light is housed in a lantern at the head of the mast. Within the lantern is fitted a clockwork and revolving mechanism supporting and carrying a fourth-order lens, which is constructed with demountable optical panels and color screens for substituting a fixed light for a flashing light or vice versa. The construction will permit of installing an incandescent oil-vapor lamp or an acetylene lamp, as desired. The focal plane of the lens is 50 feet above water. The light at present in use is acetylene gas. The lens is fixed, and the intensity of the light is equal to 1,200 candles.

Fog signal.—This apparatus consists of a 6-inch automatic rotating air siren connected to and operated by high-pressure storage tanks supplied by two compressor units, each unit being a two-cylinder air compressor driven by a two-cylinder internal-combustion engine using kerosene oil as fuel, the four-throw crank shaft being common to both engine and compressor, the cylinders all being vertical and mounted on an integral bed-plate forming the crank case. A submarine bell operated by compressed air is also fitted.

Machinery.—The propelling machinery consists of one four-cylinder, two-cycle, 200-horsepower Mietz & Weiss kerosene-oil engine of the direct reversible type, having cylinders 14 inches in diameter by 18½ inches stroke, making 225 revolutions per minute, driving a 4-blade, right-handed, cast-iron propeller, 5 feet in diameter by 5 feet 3 inches pitch. The vessel throughout is fitted with all modern appliances, including windlass, sanitary plumbing and fixtures, and drainage, fire, and heating systems, but has no electric lighting system.

Quarters.—The complement of the vessel is four officers and seven men. The officers' and crews' quarters, galley, mess rooms, pantry, bathrooms, lamp room, and other miscellaneous storerooms are located on the main deck.

Painting.—The hull is red, with "Charles" in large white letters on each side.

Cost.—This light vessel was constructed under the act of August 26, 1912, appropriating \$250,000 for light vessels for general service. The vessel was built under contract at Wilmington, Del., and the cost was \$110,065.09. Construction was started March 6, 1915, and the vessel was completed and delivered to the Government on September 25, 1916.

LIGHT VESSEL "NO. 102."

Purpose.—Light vessel No. 102, on February 24, 1917, was placed on station in the Southwest Pass, entrance to the Mississippi River, La., in the eighth district.

Structure.—The vessel is 101 feet 10 inches over all, with a molded beam of 25 feet and a displacement of 360 tons when floating at a mean draft of 11 feet 4 inches in salt water. The entire vessel is built of steel, including the bulkheads and doors forming the main deck quarters, the upper deck throughout being of the turtle-back type. A steel pilot house and chart house and a trunk forming a ventilator and light shaft over the engine room are located on the upper deck. One steel lantern mast, of a diameter sufficient to contain a ladder giving access to the lantern, is fitted. Modern devices have been fitted for the stowage of boats and anchors. A small wooden jigger mast and sail, for steadying the vessel at anchor, is fitted on the upper deck aft.

Illuminating apparatus.—The signal light is housed in a lantern at the head of the mast. Within the lantern is fitted a clockwork and revolving mechanism supporting and carrying a fourth-order lens, which is constructed with demountable optical panels and color screens for substituting a fixed light for a flashing light or vice versa. The construction will permit of installing an incandescent oil-vapor light or an acetylene lamp, as desired. The focal plane of the lens is 50 feet above water. The light at present in use is incandescent oil-vapor burned in a mantle, the lens being fitted with flash panels. The intensity of the light is equal to 24,000 candles.

Fog signal.—This apparatus consists of a 6-inch automatic rotating air siren connected to and operated by high-pressure storage tanks supplied by two compressor units, each unit being a two-cylinder air compressor driven by a two-cylinder internal-combustion engine using kerosene oil as fuel, the four-throw crank shaft being common to both engine and compressor, the cylinders all being mounted on an integral bedplate forming the crank case, all cylinders being vertical. A submarine bell operated by compressed air is also fitted.

Machinery.—The propelling machinery consists of one four-cylinder, two-cycle, 200-horsepower Mietz & Weiss kerosene-oil engine of the direct reversible type, having cylinders 14 inches in diameter by 18½ inches stroke, making 225 revolutions per minute, driving a four-blade, right-handed, cast-iron propeller, 5 feet in diameter by 5 feet 3 inches pitch. The vessel throughout is fitted with all modern appliances, including a power windlass, sanitary plumbing and fixtures, and drainage, fire, and heating systems, but has no electric lighting system.

Quarters.—The complement of the vessel is four officers and seven men. The officers' and crew's quarters, galley, mess room, pantry, bathrooms, lamp room, and other miscellaneous storerooms are located on the main deck.

Painting.—The hull is red, with "Southwest" in large white letters on each side.

Cost.—This light vessel was constructed under the act of August 26, 1912, appropriating \$250,000 for light vessels for general service. The vessel was built under contract at Wilmington, Del., and the cost was \$110,065.09. Construction was started March 6, 1915, and the vessel was completed and delivered to the Government on January 3, 1917.

**SUMMARY OF IMPORTANT CONSTRUCTION AND REPAIR WORK
UNDER GENERAL APPROPRIATIONS, COMPLETED DURING FISCAL
YEAR 1917.**

Station.	Cost.	Character of work.
SECOND DISTRICT.		
Handkerchief Light Vessel No. 3, Mass..	\$4,858	Removing old water tanks, building new deck house, and installing new windlass.
Relief light vessel No. 66, Mass.....	6,515	Docking, and repairs to complete defaulted contract of Musgrave Machine Co.
Cape Cod Canal Dolphins, Mass.....	3,871	Placing riprap around dolphins in canal approach, Buzzards Bay.
Race Point Light Station, Mass.....	4,701	Installing oil engines and compressors in place of steam.
THIRD DISTRICT.		
General depot.....	1,711	Installed heating system, machinery, motors, electric wiring, and other improvements.
Do.....	5,189	Repaired fender and bearing piles, stringers, and chocks of wharves.
Great Captain Island Light Station, Conn.	2,426	Rearranged and improved dwelling to provide two additional rooms, renewed sidewalk, etc.
Do.....	1,644	Furnished and installed new illuminating apparatus.
Long Beach Bar Light Station, N. Y....	3,887	Furnished and placed 1,660 tons of riprap and reset 160 tons around station.
Mill Rock Northerly Light, N. Y.....	1,380	Built skeleton steel light tower with tank house, furnished gas tanks and lantern, and placed light in operation.
Watch Hill Light Station, R. I.....	1,718	Furnished and installed illuminating apparatus.
Tender John Rodgers.....	1,107	Repairs to boilers and various repairs to hull and machinery.
Tender Lilac.....	3,851	General repairs.
Tender Mistletoe.....	1,268	Docked and made general repairs to hull and machinery.
Tender Myrtle.....	1,785	Docked, repaired sheathing metal, recalked seams, and other repairs to underwater body.
Relief light vessel No. 16.....	4,864	General repairs, including two new acetylene lights.
Cornfield Point Light Vessel No. 48....	1,389	General repairs.
Fire Island Light Vessel No. 68.....	1,018	Do.
Relief light vessel No. 78.....	1,809	Do.
Five Fathom Bank Light Vessel No. 79.	5,146	Do.
Ambrose Channel Light Vessel No. 87...	1,052	Do.
FOURTH DISTRICT.		
Delaware City Light Station, Del.....	1,092	Lantern post constructed and acetylene light installed thereon.
Ship John Shoal Light Station, Delaware Bay.	2,679	799 tons of riprap deposited around foundation.
Edgemoor Lighthouse Depot, Del.....	2,018	Harbor dredged.
Christiana North Jetty Light, Del.....	1,408	Walk constructed to tower.
Tinicum Island Range Rear Light Station, N. J.	1,440	New lens installed.
FIFTH DISTRICT.		
Lazaretto Lighthouse Depot, Md.....	4,800	Extended wharf 120 feet.
Long Point Depot Reservation, N. C....	1,279	Built reinforced-concrete sea wall.
Fishing Battery Light Station, Md.....	1,159	Installation of acetylene apparatus.
SIXTH DISTRICT.		
Charleston Lighthouse Depot, S. C.....	11,608	Separate projects have been taken up during the fiscal year as follows: Alterations to storehouse, track, cinder fill, concrete floor, plumbing, etc., \$3,980; plastering exterior and interior walls, \$1,199; steel shelving for depot stock, \$1,550; constructing Tradd Street brick and iron fence, \$2,750; transferring lamp shop to depot and equipment, \$2,129.
Georgetown Light Station, S. C.....	9,313	Moving keeper's dwelling from South Island to North Island, \$2,600; rebuilding South Jetty Range Front and Rear and Middle Ground Range Front and Rear Lights, \$3,116; rebuilding assistant keeper's kitchen, grading the grounds, putting in water supply, \$3,597.
Cape Romain Light Station, S. C.....	4,118	New boathouse and wharf, general repairs to dwellings and grounds.
SEVENTH DISTRICT.		
Cuts C, E, and F Ranges and Cut K Range Rear Lights, Fla. (7 lights).	1,301	Installed locomotive headlights in place of lens lanterns.
Cut G Range Lights, Fla. (2 lights).....	3,030	Established 1 reinforced-concrete 4-pile structure and 1 4-pile wooden structure with 5-day lens lantern.
Hillsboro Bay Range Lights, Fla.....	3,030	Do.
Hillsboro River Range Lights, Fla.....	3,030	Do.
Fowey Rocks Light Station, Fla.....	2,917	Scaled and painted tower, removed wooden lining of stair cylinder, and made general repairs.
Sombrero Key Light Station, Fla.....	3,999	Scaled and painted tower and dwelling and made general repairs.

SUMMARY OF IMPORTANT CONSTRUCTION AND REPAIR WORK UNDER GENERAL APPROPRIATIONS, COMPLETED DURING FISCAL YEAR 1917—Continued.

Station.	Cost.	Character of work.
EIGHTH DISTRICT.		
Bastian Bay, Bayou Cook, and Bayou Courant Lights, La.	1,643	Establishment of 1 square 4-pile post-lantern light and 2 single-pile post-lantern lights.
Brazos River Entrance Gas and Whistling Buoy and Brazos River Gas Buoy, 2, Tex.	4,000	Establishment of 1 gas and whistling buoy and 1 gas-lighted buoy.
Caucus Cut Gas and Whistling Buoy, 1A, Fla.	4,715	Establishment of gas and whistling buoy.
Galveston Jetty Light Station, Tex.	1,780	Rebuilding temporary construction wharf at light station, etc.
Do.....	1,352	Intermediate I-beams installed on struts of lower and middle sections of substructure.
Houston Channel, Tex.	2,350	Establishment of 80 second-class spar buoys.
Light vessel No. 81 (Heald Bank), Tex.	2,248	Various repairs to boilers, machinery, and hull.
Mobile Entrance Gas and Whistling Buoy, Ala.	4,715	Establishment of gas and whistling buoy.
Mobile Bar Gas Buoys Nos. 1, 2, and 3 and West Bank Gas Buoy No. 5, Ala.	8,000	Establishment of 4 gas-lighted buoys.
Tender Camellia.....	2,415	General repairs and overhauling main engine valve motion.
Tender Sunflower.....	3,723	Repairs to boilers, machinery, and general repairs to hull.
NINTH DISTRICT.		
Puntilla Point, San Juan Depot, P. R.	998	Riprap for shore protection.
San Juan Depot, P. R.	2,059	The lamp shop was torn down and rebuilt of reinforced concrete.
TENTH DISTRICT.		
Buffalo Depot, N. Y.	1,601	Provided new motor boat, No. 121.
Strawberry Island Lower Cut Range Lights, N. Y.	3,393	Reestablished on new sites, using new skeleton towers; electricity for illuminant in reflector lanterns.
Toledo Harbor Light Station, Ohio.	3,489	Furnished and placed approximately 1,400 tons of riprap stone around foundation.
Buffalo Light Station, and Fair Haven Range, N. Y.	1,898	Provided new launch for each station, Nos. 123 and 124.
Grand Island Range Lights, N. Y.	5,820	Established two acetylene range lights on skeleton steel towers.
Tender Crocus.....	5,519	General repairs.
Do.....	1,300	Provided new launch, No. 122.
ELEVENTH DISTRICT.		
Split Rock Light Station, Minn.	3,925	Building new tramway and installing gasoline hoisting engine; constructing extension to landing dock.
Passage Island Light Station, Mich.	9,467	Installation of duplicate compressed-air diaphone fog signal in place of steam; installing hot-water heating plant in fog-signal building; extending present dock in concrete.
Keweenaw Harbor of Refuge, Mich.	1,214	Raised dwelling and built concrete basement wall underneath; laid cellar floor of concrete and minor other repairs.
Pilgrim Point Light Station, Mich.	3,585	Rebuilt structure in concrete and provided a complete acetylene lighting equipment.
Devils Island Light Station, Mich.	1,771	Moved old barn and remodeled into second assistant keeper's dwelling; made miscellaneous repairs at the station.
Thunder Bay Island Light Station, Mich.	1,364	Remodeled old fog-signal building into second assistant keeper's dwelling; repaired dock and made miscellaneous repairs to station.
Eagle River Shoals Fog Signal Station, Mich.	6,150	Established new electric siren fog-signal station, complete with quarters for 2 keepers.
Grassy Island North Channel Range Light Station, Mich.	2,572	Rebuilt concrete base for tower; discontinued Ecorse Rear Range, steel tower in its place; built concrete shore protection around dwellings at upper end of range; rebuilt wharves.
Tender Amaranth.....	2,001	General repairs.
Light vessel No. 82.....	18,943	Reconstructed superstructure and interior work in steel, installed lighting equipment, installed submarine bell, equipped vessel complete, including boats, anchors, etc.; completely overhauled boiler and machinery.
TWELFTH DISTRICT.		
Menominee Pierhead Range, Rear Light, Mich.	1,071	Established locomotive headlight on 60-foot steel tower; repaired elevated walk.
Ludington North Breakwater Light, Mich.	1,196	31-foot steel tower with 200-mm. acetylene light erected on base of old concrete tower.
South Haven Range Rear Light, Mich.	1,119	Established 50-foot steel tower and locomotive headlight.
Tender Sumac.....	1,108	Docking; cleaning and painting underwater body; repairs to tail shaft and bearings.
Kenosha Light Station, Wis.,	2,265	Repairs to fog-signal building and boathouse; reerecting 1,040 linear feet of metal elevated walk on new concrete superstructure of north pier.

SUMMARY OF IMPORTANT CONSTRUCTION AND REPAIR WORK UNDER GENERAL APPROPRIATIONS, COMPLETED DURING FISCAL YEAR 1917—Continued.

Station.	Cost.	Character of work.
TWELFTH DISTRICT—continued.		
Racine Reef Light Station, Wis.	3,207	Placing 1,000 tons of heavy riprap stone for protection of pier.
Charlevoix South Pierhead Light Station, Mich.	1,205	General repairs to keeper's dwelling, station buildings, etc.; stiffening of steel tower on north pierhead.
Eleven-Foot Shoal Light Vessel No. 60, Mich.	3,815	General repairs, including new boiler and steam whistle.
Sturgeon Bay Canal Light Station, Wis.	2,755	Northwest Entrance No. 3 Light—establishment of 300-mm. acetylene light and equipment on 15-foot steel tower; Northwest Entrance to Cut No. 4 Light—establishment of 200-mm. acetylene light and equipment on 15-foot steel tower.
Sheboygan Breakwater Light Station, Wis.	20,573	Moved tower from north pierhead to outer end of north breakwater; established acetylene light, air-siren fog signal in tower and erected fog-signal power house on inner end of breakwater.
Michigan City West Pierhead Light, Ind.	1,194	Established 300-mm. acetylene light and equipment.
Tender Hyacinth.	2,418	General repairs to boiler, propelling machinery, decks, and upper works.
Tender Sumac.	1,011	Do.
North Manitou Light Vessel No. 56, Mich.	6,995	General rebuilding of hull: repairs to decks and upper works; overhauling and repairing fog-signal and propelling machinery.
SIXTEENTH DISTRICT.		
Cape Hinchinbrook Light Station, Alaska.	1,181	Concrete footing to wharf, quarters partly replastered, waterproofed main building, and laid new sewer.
Scotch Cap Light Station, Alaska.	1,034	Installed diaphone air fog signal, replacing 10-inch air whistle.
Seal Rocks Light, Alaska.	1,069	Unwatched acetylene light established.
Tender Fern.	3,797	Buoy port and apron, minor alterations and general repairs.
Tender Kukui.	4,401	Machinery replacements and general repairs.
SEVENTEENTH DISTRICT.		
Tongue Point Lighthouse Depot, Oreg.	2,192	Repairs to warehouse.
Cape Flattery Light Station, Wash.	4,662	Installing water and sewer systems and plumbing in all dwellings; rebuilding hoisting engine house and other repairs.
Do.	1,853	A new type G diaphone was installed in place of a first-class air siren.
Destruction Island Light Station, Wash.	4,902	General repairs, including new water and sewer systems and plumbing in dwellings.
Ediz Hook Buoy Depot, Wash.	1,110	New shed for buoy storage, tramway extended, storage platform extended, and water tank provided.
Mukiltee Light Station, Wash.	3,166	General repairs, including concrete-core walls, stone revetment, and the filling and grading of grounds.
Slip Point Light Station, Wash.	4,149	General repairs, including plumbing, water system, new outbuildings, and walks.
Semiamoo Harbor Light Station, Wash.	5,635	Repairs to substructure.
Slaughters Bar Ranges and Lights, 1 and 3, Columbia River.	1,476	Establishment of oil lights on pile substructure.
Tender Heather.	4,089	General repairs.
Tender Manzanita.	4,502	Do.
Columbia River Light Vessel No. 88.	1,879	Do.
Relief light vessel No. 92.	1,435	Do.
Swiftsure Bank Light Vessel No. 93.	1,296	Do.
EIGHTEENTH DISTRICT.		
Farallon Light Station, Cal.	2,928	Changing first-class air siren to a type K diaphone.
Fort Point Light Station, Cal.	1,345	Timber bridge 78 feet long across gap from reservation to top of Fort Winfield Scott.
Goat Island Depot and Goat Island Light Station, Cal.	2,687	Installation of electric power and lighting system at lighthouse depot; replaced type A, iov, apparatus with electric incandescent light at light station.
Point Conception Light Station, Cal.	7,237	Replacing steam fog-signal boilers and 12-inch steam whistle with duplicate gas engines and air compressors operating a type G diaphone.
NINETEENTH DISTRICT.		
Kipahulu Light Station, Hawaii.	1,982	Establishment of a 300-mm., high-pressure, automatic acetylene-gas light.
Lahaina Light Station, Hawaii.	1,549	Construction of new reinforced-concrete tower on new site and improvements to sea-wall boundary.
Pauwela Point Light Station, Hawaii.	1,689	Repairs and improvements to combined light tower and dwelling.

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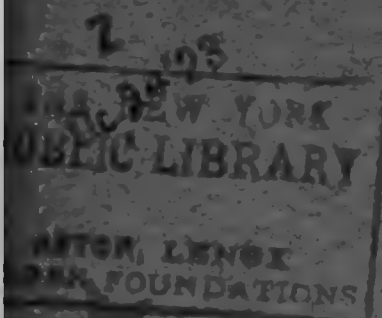
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ANNUAL REPORT

OF THE

COMMISSIONER OF LIGHTHOUSES

TO THE

SECRETARY OF COMMERCE

FOR THE

FISCAL YEAR ENDED JUNE 30, 1918



WASHINGTON
GOVERNMENT PRINTING OFFICE
1918



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REPORT OF THE COMMISSIONER OF LIGHTHOUSES.

DEPARTMENT OF COMMERCE,
BUREAU OF LIGHTHOUSES,
Washington, September 15, 1918.

SIR: The following report is submitted of the operations of the Lighthouse Service for the fiscal year ended June 30, 1918:

The past year has been an unusually eventful and active one in the history of the Lighthouse Service. Under the Executive order issued shortly after the entering of the United States into the war nearly all of the lighthouse tenders, and a number of other units, with a total of 1,132 persons, have been serving with the Navy Department and at the same time continuing the work of maintaining the aids to navigation. The general lighthouse act passed in June, 1918, provides a retirement system for the field force of the Lighthouse Service and more adequate compensation for the light keepers and district officers. The important new lighthouse on Navassa Island in the West Indies was completed in October, 1917.

COOPERATION.

In accordance with the established custom of the Service, effort has been continued to consult the needs of maritime interests and to cooperate effectively with other branches of the Government in related work. The most important work of cooperation has been that with the Navy and War Departments in accordance with law and Executive order. The naval appropriation act of August 29, 1916, authorized the President, whenever in his judgment a sufficient national emergency exists, to transfer to the service and jurisdiction of the Navy Department, or of the War Department, such vessels, equipment, stations, and personnel of the Lighthouse Service as he may deem to the best interest of the country; and also provided that the Secretary of the Navy, the Secretary of War, and the Secretary of Commerce shall jointly prescribe regulations governing the duties to be performed, etc. These regulations were issued April 11, 1917. By Executive orders, 46 lighthouse tenders, 4 light vessels, and 21 light stations have been transferred to the Navy Department, including a total of 1,132 persons employed thereon. These vessels and stations have since that time performed various duties under the Navy and have also continued the maintenance of the aids to navigation and other work necessary for the Lighthouse Service.

In addition to the officers and employees directly transferred, the superintendents of lighthouses and various other officers of the several lighthouse districts (46 persons) have reported to the Navy and Army authorities, and have rendered service in coordinating the military and lighthouse duties of the transferred portions of the Lighthouse Service.

The duties performed by the transferred units directly for the military and naval authorities are, of course, matters pertaining to those departments, but they consist principally of work on submarine nets and buoyage in connection therewith, patrol and watch service, drill in mine laying, etc. Prior to the war, for a number of years, a large proportion of the lighthouse tenders had been equipped by the War Department with mine-laying equipment, and had periodic drills in this work.

The regular work of the Lighthouse Service, the maintenance of lighthouses, lightships, buoys, and beacons, is of extreme importance in war time, to safeguard and expedite the movement of both merchant ships and naval vessels. This work has been increased rather than diminished by war-time demands and difficulties. The Lighthouse Service had prior to the war no surplus of vessels, equipment or personnel, beyond that necessary for the efficient maintenance of the existing establishment. The regulations under the law and Executive order providing for cooperation with the War and Navy Departments therefore contemplated the continuance of lighthouse work by the transferred units, and this has been done. By strenuous work on the part of the whole Service, and particularly the district and vessel officers, the great system of aids to navigation is being kept up in addition to the extra duties assigned to vessels and men.

In addition to the work done by the tenders and other units transferred, directly under the orders of military and naval officers, the Lighthouse Service cooperates in many other ways.

There has also been cooperation with the Navy and Treasury Departments in the improvement of coast communication facilities.

The following additional work has been performed: Various investigations have been made at the request of the Department of Justice and the military and naval information services. Officers of the marine engineering division of the Lighthouse Service have assisted the Shipping Board in various matters respecting the design and sea trials of various types of vessels, including concrete vessels. An officer of the Lighthouse Service is engaged on the work of the chain section, War Industries Board, having to do with the standardization and allocation of iron and steel chain for the different activities of the Government. The Commissioner of Lighthouses is serving as the representative of the Department of Commerce on the New York Harbor Wage Adjustment Board. A scientific assistant in the Lighthouse Service has assisted a naval technical board.

The Lighthouse Service endeavors to cooperate in every possible way with all other branches of the Government.

During the fiscal year 1918 services in saving life and property were rendered and acts of heroism performed by employees of the Lighthouse Service on 158 occasions. Particulars as to a few of the instances of assistance and cooperation by tenders and personnel of the Service are briefly mentioned as follows:

The tender *Tulip*, on February 7, 1918, during severe ice conditions, rendered assistance to the quartermaster's steamer *Pickering*, which was in distress at the entrance of New London Harbor, by reason of a damaged rudder, and towed that vessel to New London.

On February 20, 1918, the tender *Tulip* assisted a Navy transport by picking up a mooring which had been slipped and buoyed by the transport.

The tender *Anemone* rendered service on January 4, 1918, during severe ice conditions, to the steamer *Priscilla* of the New England Steamship Co., which was held up in the ice in lower Newport Harbor, by enabling the latter to reach her dock.

The tender *Oleander* rendered valuable assistance during February to vessels in distress as a result of the unusual ice conditions on the Ohio and Mississippi Rivers. Among the vessels assisted were several United States Engineer Department barges loaded with knock-down railroad cars for France, valued at \$100,000 each.

On February 3, 1918, the tender *Zizania*, while in the vicinity of Rockland, Me., was requested to proceed to Vinalhaven with mail, passengers, and provisions, the town having been shut off from all sources of supplies for upward of 11 days on account of severe ice conditions. Forty-three sacks of mail, 3 tons of freight, and 20 passengers were transported, and mail, freight, and passengers were transported from Vinalhaven to Rockland. On the return trip to Rockland the tender towed a disabled lobster boat to Rockland and then proceeded to the assistance of a schooner which was jammed in the ice in the bay and moving seaward.

On request of a Liberty loan committee the superintendent of lighthouses at Tompkinsville delivered and set up in the City Hall Park, New York City, a bell for furthering the campaign in behalf of a Liberty loan.

The Shipping Board recruiting service, John Hopkins University, was given assistance by an assistant superintendent in the Lighthouse Service, who conducted classes in steam engineering at the university by authority of the Bureau.

Arrangements were made for having the tender *Cedar* transport machinery to the Pribilof Islands, for the Bureau of Fisheries.

Acknowledgment has been received from various shipmasters and maritime interests of valuable assistance rendered by lighthouse tenders during the year, especially during the severe ice conditions of the winter, in aiding vessels in distress and keeping channels open for navigation.

Acknowledgment was received for cooperation during the past summer of the superintendent of the seventh lighthouse district with the wire-drag work of the Coast and Geodetic Survey.

Lake steamship interests have expressed their appreciation for efficient service rendered by the Lighthouse Service during the year in maintaining aids to navigation on the Great Lakes.

LIGHTHOUSE ON NAVASSA ISLAND.

The new light station on Navassa Island, West Indies, was placed in commission October 21, 1917. This was built under an appropriation of \$125,000 approved October 22, 1913, and was rendered necessary because of the increased traffic through the Windward Passage following the opening of the Panama Canal. Navassa Island lies in the passage between Haiti and Jamaica, and the light station is located on the highest part of the island. The tower is of reinforced concrete. The light is 395 feet above the sea, has 47,000 candlepower, and is visible 27 miles. The light has proved an important aid to vessels going through the Panama Canal to and from Atlantic ports of the United States. A detailed description of this station is given on page 73.

LEGISLATION ENACTED AFFECTING THE LIGHTHOUSE SERVICE.

The general lighthouse act approved June 20, 1918, contains provisions of much importance to the Lighthouse Service, including a retirement system for the field force, need for which has been pointed out from the first annual report of the Commissioner of Lighthouses in 1911, and emphasized in each succeeding report. Other important features of this act include more equitable compensation for the officers in charge of lighthouse districts, whose designation is changed from "lighthouse inspector" to "superintendent of lighthouses"; for the raising of the pay of keepers of lighthouses and an increased ration allowance for them. Provision for the payment of travel and subsistence expenses of teachers instructing the children of lighthouse keepers, and arrangements for the sale of publications of the Lighthouse Service are also included in this act and authorizations for a number of valuable special works of construction. The establishment and maintenance in the discretion of the Commissioner of Lighthouses of post lantern lights and other aids to navigation on Lakes Union and Washington, in the State of Washington, was also authorized by this act.

The appropriations for the maintenance of the Lighthouse Service for the fiscal year 1919 are \$6,150,430 being \$811,750 in excess of those for the preceding fiscal year. In addition there are special appropriations aggregating \$723,000 for various new works.

The following works were authorized by the act of June 20, 1918, at the limits of cost specified, but no appropriation of funds was made: Constructing or purchasing and equipping lighthouse tenders and light vessels to replace vessels worn out in service in the third, fifth, and eighth lighthouse districts, or for use in the Lighthouse Service generally, \$760,000; enlarging and improving the lighthouse depot at Portsmouth, Va., in the fifth lighthouse district, or establishing a new depot, \$275,000; improving, repairing, establishing, and moving aids to navigation in St. Marys River, Mich., and vicinity, \$80,000; extending and enlarging the machine shop at the general lighthouse depot, Tompkinsville, Staten Island, N. Y., \$30,000; establishing and improving aids to navigation in the Virgin Islands of the United States and adjacent waters, West Indies, \$50,000; improving and extending the wharves at the general lighthouse depot, Tompkinsville, Staten Island, N. Y., \$65,000; improving the aids to navigation and installing new aids in the Potomac River, Md. and Va., \$95,000; constructing and equipping a lighthouse depot for the eighth lighthouse district at New Orleans, La., or vicinity, \$88,500; and purchase of additional gas buoys for the improvement of aids to navigation in the fifth lighthouse district, \$125,000 (of which \$65,000 was appropriated by the sundry civil act of July, 1918).

The deficiency act approved October 6, 1917, made an appropriation of \$20,000 for repairing damage by hurricane at Aransas Pass Light Station, Tex.

The deficiency act of March 28, 1918, appropriated \$100,000 for repairing general hurricane damage to aids to navigation on the Gulf Coast; \$150,000 for repairing ice and storm damage to aids to navigation on the Atlantic coast; \$60,000 for repairs to wharves at the general lighthouse depot, Tompkinsville, N. Y., and \$15,000 for the

installation of an electrically operated fog-signal whistle at Nantucket Harbor, Mass.

The sundry civil act approved July 1, 1918, made the following appropriations: Depot for second lighthouse district, \$85,000; depot for sixteenth lighthouse district, \$90,000; improvements of depot at Detroit, Mich., \$53,000; Guantanamo Bay, Cuba, aids to navigation, dwelling for keepers, and improvements, \$14,000; Sand Island Light Station, Ala., improvements, \$37,000; Spectacle Reef Light Station, Mich., improvements, \$28,000; Ambrose Channel, N. Y., improving system of lighted buoys, \$26,000; fifth lighthouse district, purchase of additional gas buoys for improving aids to navigation, \$65,000; Joe Flogger Shoal, Delaware River, aids to navigation, unexpended balance of appropriation of \$40,000 for light and fog-signal station, made by act of June 30, 1906, is made available for establishing gas buoys and improving aids to navigation in the vicinity of Joe Flogger Shoal, Del.; the appropriation of \$15,000 for installation of fog-signal whistle on east breakwater, Nantucket Harbor, Mass., contained in deficiency appropriation act of March 28, 1918, is made available for a fog-signal bell at the same point. With the exception of the depot for the sixteenth lighthouse district, these projects were authorized by the acts of August 28, 1916, and June 20, 1918.

The sundry civil act of July 1, 1918, contained authority for the restoration of lighthouse structures with funds from the appropriation, "General expenses, Lighthouse Service;" and also for commuting the subsistence of working parties in the field, in connection with the appropriation, "General expenses," and making payment of the money accruing from such commutation to the persons having charge of the messes for the working parties.

The legislative act of July 3, 1918, provided for increased compensation during the fiscal year 1918 at the rate of \$120 per annum to all civilian employees of the Government, with certain exceptions, whose compensation does not exceed \$2,500 per annum, in lieu of the 5 and 10 per cent increase in force during the preceding fiscal year, but as a provision of the law excluded employees whose duties require only a portion of their time, a considerable number of lighthouse employees were affected and suffered what amounted to a virtual reduction in pay at a very inopportune time.

The act of July 1, 1918, making appropriations for the naval service for the fiscal year 1919, transferred to the Navy Department the unused Mare Island Light Station, Cal. This station was discontinued July 1, 1917, and is not further required for lighthouse purposes.

AIDS TO NAVIGATION.

During the fiscal year ended June 30, 1918, there was a net increase of 446 in the total number of aids to navigation maintained by the Lighthouse Service. There was an increase of 27 lighted buoys (including 14 float lights), 52 unlighted buoys, and 76 minor lights.

Fixed lights were changed to flashing or occulting at 13 stations. The illuminant of 3 lights was changed to incandescent oil vapor, the illuminant of 27 lights (including 2 light vessels and 10 buoys) was changed to acetylene, the illuminant of 14 lights was changed to electric incandescent.

On June 30, 1918, there were maintained by the Lighthouse Service 15,673 aids to navigation, including 5,545 lights of all classes and

587 fog signals (not including 81 whistle and 243 bell buoys), of which 51 are submarine signals.

The table following gives a summary of the aids to navigation, under each class, established and discontinued during the fiscal year, and also the net increase, and the number in commission at the end of the fiscal years 1917 and 1918.

Class.	1918			Total, June 30—	
	Estab- lished.	Discon- tinued.	In- crease.	1917 ^a	1918
Lighted aids:					
Lights (other than minor lights).....	47	24	23	1,708	1,731
Minor lights.....	146	70	76	2,970	3,046
Light-vessel stations.....		1	b 1	53	52
Gas buoys.....	40	27	13	545	558
Float lights.....	29	14	14	144	158
Total.....	261	136	125	5,420	5,545
Unlighted aids:					
Fog signals.....		1	b 1	537	536
Submarine signals.....				51	51
Whistling buoys, unlighted.....	1	1		81	81
Bell buoys, unlighted.....	7	5	2	241	243
Other buoys.....	187	137	50	6,846	6,896
Day beacons.....	301	31	270	2,051	2,321
Total.....	496	175	321	9,807	10,128
Grand total.....	757	311	446	15,227	15,673

^a Differences from statistics published in 1917 report are due to minor discrepancies in previous count.

^b Decrease.

Improvements in aids to navigation in the Service generally have been made during the year as follows: Flashing or occulting lights were installed in place of fixed lights at 13 stations; incandescent oil-vapor lights were substituted for oil-wick lamps at 3 stations; acetylene or electric incandescent lights were substituted for other lights at 41 stations, including 2 light vessels and 10 buoys.

As previously mentioned, a new light station was established at Navassa Island, West Indies. A detailed description is given on page 73.

A number of important items of construction work were in progress at the close of the year, including a new light and fog signal at Chicago Outer Harbor, Ill., Chester and Marcus Hook Ranges, Delaware River, and a light and fog signal at Conneaut, Ohio.

It is believed that the systematic methods of improvement and the use of modern apparatus in increasing the number and brilliancy of aids have been of value to the safety of commerce.

Subsequent to the close of the fiscal year, on August 6, 1918, light vessel No. 71 was sunk on her station on Diamond Shoals by an enemy submarine. The crew took to their boats and reached shore without injury.

A severe hurricane visited the Gulf coast on September 27-29, 1917, damaging lighthouse property severely from the Mississippi River Passes east to Pensacola Bay.

During the months of January and February, 1918, the unusually cold weather—the most severe of record since 1856—occasioned a large amount of ice damage on the Atlantic coast as far south as the Cape Fear River, N. C. Cross Rip Light Vessel No. 6, Mass., was lost, having been torn from her moorings by a large field of floating

ice and carried seaward, where she disappeared, with six men on board. Every available means was taken by the Lighthouse Service for rendering assistance and making search for the light vessel, but without success. Another light vessel marking the lower entrance to Chesapeake Bay, Va., was dragged from her station by the ice, but was rescued by the lighthouse tender *Cypress*.

Many light stations and other aids to navigation were damaged or destroyed, including upward of 150 aids in the waters adjacent Maryland, Virginia, and North Carolina. The estimated damage amounted to nearly \$400,000, and a considerably larger amount than this will be required to reestablish the stations and provide against similar damage to these stations in the future. Important stations either wholly or practically destroyed were Choptank River, Md.; Bowlers Rock, Va.; Old Plantation Flats, Va.; North River, N. C.; and Wade Point, N. C. The following important stations were seriously damaged, or weakened so as to require strengthening: York Spit, Va.; Windmill Point, N. C.; Tangier Sound, Va.; Cobb Point Bar, Md.; Ragged Point, Md.; Thomas Point Shoal, Md.; Long Shoal, N. C.; Hatteras Inlet, N. C.; Brant Island Shoal, N. C.; and Neuse River, N. C.

An appropriation of \$150,000 was made by deficiency act of March 28, 1918, for repairs rendered necessary by this ice damage. Estimate for further appropriations for this object has been submitted, including riprap protection against future ice damage wherever the expense involved by such protection is considered justified as compared with the cost of rebuilding the aids.

ALASKA.

Special attention has been given to Alaska. Eleven new lights were established; 3 lights were changed from fixed to flashing; 1 gas and bell buoy was established, also 13 unlighted buoys, and 5 beacons. It is expected that 16 other lights will be established during this season, as well as 2 gas and bell buoys. Special appropriations aggregating \$290,000 will be asked of Congress to continue the work of general increase of lights and buoys in Alaska, for a light and fog signal at Cape Spencer, Cross Sound, and for repairs and improvements at existing light stations.

The total number of aids to navigation in Alaska, including lights, gas buoys, fog signals, buoys, and daymarks, in commission at the close of the fiscal year ended June 30, 1918, was 439, including 161 lights and 7 gas buoys, representing an increase of 131 lighted aids since June 30, 1910, or 354 per cent. The following table, which gives the total number of aids to navigation on June 30 of 1910, 1915, and of each succeeding year, illustrates the progress in establishing aids in the Territory:

Aids.	1910	1915	1916	1917	1918
Lights.....	37	112	147	152	161
Gas buoys.....				7	7
Fog signals.....	9	10	11	11	11
Submarine bell.....				1	1
Buoys.....	84	167	181	189	198
Daymarks.....	30	49	49	56	61
Total.....	160	338	388	416	439

The acts of August 1, 1914 and June 12, 1917, each appropriated \$60,000 for establishing and improving aids to navigation in Alaskan waters. During the fiscal year 1918, one gas buoy, one oil post lantern, and six acetylene lights were established with funds from these appropriations; and the illuminating apparatus and other material for eight additional acetylene lights and three gas buoys purchased, of which several were nearing completion at the close of the fiscal year.

Special appropriations aggregating \$290,000 will be asked of Congress to continue the work of general increase of lights and buoys in Alaska, including a light and fog signal at Cape Spencer, Cross Sound, and other new aids, and improvements at existing stations. The sundry civil act of July 1, 1918, contained an appropriation of \$90,000 for a lighthouse depot with necessary equipment for this district.

The new lighthouse tender *Cedar* has been in commission throughout the year, attending to lighthouse work in Alaska, and has proven satisfactory for this purpose.

GUANTANAMO, SAMOA, AND GUAM.

The aids to navigation in the outlying United States territory at Guantanamo Bay, Cuba, the American Samoan Islands, and the island of Guam are maintained under the supervision of the naval commandants by means of allotments made from the appropriations for the Lighthouse Service. Reports have been received from naval officers in local charge indicating that the aids have been properly maintained, at an approximate annual expense as follows: Guantamo, \$3,971.19; Samoa, \$949.76; Guam, \$211.53.

VIRGIN ISLANDS.

The lighthouse work in the islands of St. Thomas, St. Croix, and St. John, with the outlying rocks and islets, formerly constituting the Danish West Indies and now the Virgin Islands of the United States, was by Executive order, dated July 20, 1917, placed under the Lighthouse Service, following the customary procedure in such cases.

The care and maintenance of the aids were formally transferred to the Lighthouse Service by the military governor of the islands on August 16, 1917.

An estimate of \$50,000 has been submitted to Congress for establishing necessary additional aids for these islands. These additional aids were authorized by act of June 20, 1918, but no appropriation was made therefor.

ENGINEERING AND CONSTRUCTION.

The most important item of construction work completed during the fiscal year was the new light station on Navassa Island, West Indies. This work is described on page 73. Thirty-two aids, including 23 lighted beacons and buoys and 9 unlighted buoys, were established at the approaches to the Cape Cod Canal, Mass.

Improvement of aids to navigation at Ashtabula Harbor, Cleveland Harbor, and Toledo Harbor, Ohio, was completed. This work is described on pages 74 and 75. Other important works in progress at the close of the fiscal year included Woods Hole (Mass.) lighthouse

depot, completing electric lighting and equipment; aids to navigation, Hudson River, N. Y.; aids to navigation, East River, N. Y.; Great Salt Pond Light Station, R. I., improvements; Hunts Point, N. Y., light and fog signal; Staten Island lighthouse depot, N. Y., improvements; aids to navigation, Delaware River, Pa. and Del.; aids to navigation, St. Johns River, Fla.; repairing and rebuilding aids to navigation damaged by storm and ice, Atlantic Coast; repairing and rebuilding aids to navigation damaged by hurricane, Gulf coast and Mississippi River below New Orleans; repairing and improving aids to navigation, Florida Reefs, Fla.; improving aids to navigation, Lorain Harbor and Conneaut Harbor, Ohio; improving aids to navigation, Detroit River, Mich.; establishing a light and fog signal, Sand Hills, Mich.; establishing a light and fog signal at White Shoal, Mich.; rebuilding Chicago Harbor Light Station, Ill.; improving aids to navigation, Alaska; improving aids to navigation, Puget Sound, Wash.; improving aids to navigation, Washington and Oregon. These works are described on pages 39 to 47.

IMPROVEMENT OF APPARATUS AND EQUIPMENT.

An occulting mechanism, actuated by the heat of the flame, for use in post lanterns, was given further test, with results indicating the development of an automatic occulting post lantern that will give satisfactory results.

A device for handling sinkers, ballast balls, etc., was installed at Key West lighthouse depot. This device consists of a pair of heavy wheels mounted on a bowed axle provided with a crane-hook chain sling, mounted at the center of the axle.

An improvement has been made in the method of placing riprap protection at light stations by depositing the stones regularly instead of at random, packing tightly, and filling up the crevices with smaller stone, and in work where large deposits are required the annular mass of large stones is first deposited as above, after which the inner space is filled with smaller stone.

For testing purposes two spruce spar buoys were placed in the comparatively warm waters of Vineyard Sound, Mass., for observation as to action of the teredo, etc. After a year in the water these buoys do not appear to be water-soaked or worm-eaten more than cedar buoys and so far have given satisfactory results.

The substitution of cast-iron horns for copper horns in connection with compressed-air sirens has proved satisfactory where tried.

The use of a thermostat designed to warn keepers by ringing a bell when undue fluctuations occur in operating oil-vapor lamps has been extended with satisfactory results.

Experiments have been conducted with success at the general depot with a view to the manufacture of 375-millimeter (about 15 inches) pressed-glass buoy lenses for use in place of the present expensive cut-glass lenses.

The new type L gas and whistling buoy, designed for use in channel work and in locations where a larger buoy would be too heavy, has proven satisfactory.

The work of standardization has been extended during the past year as heretofore, and in many cases articles and parts have been completely standardized and are now interchangeable, so that repair parts may be kept on hand for issue at short notice.

Kerosene for fuel, replacing coal, was in use in the galley range aboard several vessels with good results and has been found more satisfactory than coal.

The continued use of oil engines in place of steam for power and for operating fog signals has demonstrated the greater economy and convenience of such apparatus, and the use of these engines is being extended as boilers now in service become unfit for further use.

ORGANIZATION OF THE LIGHTHOUSE SERVICE.

The general organization of the Service remained unchanged during the fiscal year, except that the designations of officers in charge of lighthouse districts, formerly known as "lighthouse inspectors," were by section 7 of the act approved June 20, 1918, changed to "superintendents of lighthouses." The employees formerly designated superintendents were changed by Department order to first assistant superintendents, or assistant superintendents. The duties and responsibilities of these officers and employees remain the same as previously.

PERSONNEL.

The following table gives the number of employees (all authorized positions, including some vacancies) of the Lighthouse Service at the end of the fiscal year and a comparison of the totals with those for the previous fiscal year:

EMPLOYEES IN THE LIGHTHOUSE SERVICE ON JUNE 30, 1918.

District.	Inspectors, engineering force, draftsmen, aids, appointed foremen, and mechanics.	Clerks, messengers, janitors, and office laborers.	Depot keepers and assistants, including laborers.	Light keepers and assistants.	Laborers and laborers-in-charge of lights (appropriation "Salaries, keepers of lighthouses").	Laborers-in-charge of post lights and buoys (appropriation "General expenses").	Custodians of reservations.	Officers and crews on tenders and light vessels.	Field force for construction and repair (registered).	Field force for construction and repair (unregistered).	Total.
Bureau.....	13	25									38
First.....	3	6	1	114	2			71	10	0	216
Second.....	4	7	2	78	10		1	220	3	11	336
Third.....	21	31	16	178	32	56	2	277	177	44	834
Fourth.....	5	5	3	54	3	4	7	32	5	6	121
Fifth.....	10	10	41	166	97	20		278	14	3	639
Sixth.....	5	7	2	55	10	26		139	1	12	260
Seventh.....	2	3	1	40	1	7		33	4	3	94
Eighth.....	6	9	15	110	32	35		108	9	46	370
Ninth.....	2	5	1	40	9			24	15	0	102
Tenth.....	7	5	2	68	1		1	28	7	27	145
Eleventh.....	9	6	6	159	10	2	2	113	14	52	273
Twelfth.....	8	6	4	152	18	2	1	95	4	15	305
Thirteenth.....	1	2				321		19			343
Fourteenth.....	1	2				535					538
Fifteenth.....	1	2				370		20			393
Sixteenth.....	5	4	1	32		21		48	1	7	119
Seventeenth.....	7	6	4	78	15	120		108	4	3	345
Eighteenth.....	6	6	7	107	14	5		93	3	10	251
Nineteenth.....	4	3	1	26	2			30	2	5	73
Total, 1918.....	120	150	107	1,457	256	1,524	14	1,736	276	250	5,899
Total, 1917.....	122	149	103	1,464	242	1,526	13	1,704	273	200	5,796
Increase.....		1	4		14		1	32	3	50	103
Decrease.....	2			7		2					

Up to June 30, 1918, a total of 123 persons from the Lighthouse Service, exclusive of those transferred by Executive order, had entered the Army or Navy, making with those transferred a grand total of 1,255 employees who have entered the military services, or 22 per cent of the normal force of the Lighthouse Service.

ADMINISTRATION METHODS AND ECONOMIES.

By a decision of the Bureau of War Risk Insurance the personnel of Lighthouse Service transferred to the service and jurisdiction of the Navy and War Departments are within the terms of the war risk insurance act of October 6, 1917.

The Regulations for the Lighthouse Service were revised and reprinted.

A compilation of data relating to hours of fog and its relative prevalence at different seasons of the year was made from information on file, based on the regular records at fog-signal stations. Records of fog have been kept in a systematic manner since 1885 and are now sufficiently complete to provide material for study of this matter from both meteorological and engineering standpoints.

Careful attention was given during the fiscal year both by the Department and the Bureau to conditions affecting pay and subsistence, particularly on board vessels. A more detailed statement in reference to this question is made on page 23.

With a view to lessening office work, the Department granted authority for discontinuing certain routine work in the Bureau's office in connection with appointments, etc. The department also approved a plan for simplifying methods in connection with the appointment, promotion, etc., of keepers of lighthouses and laborers attending lights.

As a measure of economy, the use of cotton towels for the Lighthouse Service has been adopted in place of the linen towels heretofore used.

The President, by Executive order of October 13, 1917, transferred about 1.22 acres of land on Sand Island, Oahu, Hawaii, from the War Department to the Department of Commerce, for lighthouse-depot purposes, and by Executive order of October 18, 1917, reserved Huckleberry Island, in Padilla Bay, Wash., containing 11.74 acres, for lighthouse purposes.

At the Southern Commercial Congress, held in New York City October 13 to 18, 1917, a universal flashing lens and lantern, eight-day post lantern, electric lamp substituting device, and other features of interest pertaining to the Lighthouse Service were displayed.

Great effort was made to keep lights on the Great Lakes in commission as long as possible after the usual time for the close of navigation, in compliance with the desires of maritime interests, but such severe weather conditions set in about December 8 that practically all Lake traffic was brought to a standstill within a week, notwithstanding the efforts made to keep the lights in commission and the channels open for navigation.

Valuable work was accomplished by lighthouse tenders in keeping channels open for navigation along the North Atlantic coast during the unusually severe freezing weather of the past winter.

The employees of the Lighthouse Service have subscribed liberally to the three Liberty loans and the war savings stamps issue. They have also displayed commendable activity in the food-conservation campaign, and much work has been done in the way of raising vegetables, canning fish, and in similar activities.

Systematic inspections have been continued in the various lighthouse districts of technical work, business methods, and property accounts.

COST-KEEPING SYSTEM AND RESULTS.

A standard method of cost keeping has been continued in effect throughout the fiscal year.

The costs are based on the actual expenditures during the fiscal year, whether of money or supplies. The figures given show all disbursements made by the Lighthouse Service, including expenditures on account of vessels, etc., temporarily transferred to the Navy Department, but do not include expenditures made direct by the Navy Department on account of such vessels, etc. The information from this cost-keeping system is useful in preparing estimates, planning work, effecting economies, and comparing the efficiency of different districts, vessels, light stations, apparatus, methods, etc.

A generalized summary of costs for the fiscal year ended June 30, 1918, follows, as derived from this cost-keeping system. Notwithstanding the most careful and painstaking efforts to economize in every direction, the continued extraordinary advance in the price of labor and materials is clearly shown in the increased costs reported for practically all features.

[Amounts are stated to nearest even dollar, causing occasional minor discrepancies in totals. Difference from total expenditures reported elsewhere is due to inclusion of Bureau salaries, printing expenses, and adjustment of inventories of articles furnished from stock.]

TOTAL COSTS OF PRINCIPAL FEATURES.

Feature.	Maintenance expenses.					Betterment expenses.				Grand total.	Per cent.
	Salaries.	Subsistence.	General supplies.	Incidental expenses.	Total.	Repairs and improvements.			Total.		
						Labor.	Materials and supplies.	New works.			
Administration a.....	\$331,332	.....	\$57,302	\$2,902	\$391,536	.....	.....	.....	\$391,536	6
Distributive charges b.....	1,080,771	\$252,533	580,385	29,000	1,942,690	\$178,259	\$175,925	\$45,903	\$400,087	37	
Aids to navigation c.....	1,720,903	275,462	506,699	20,227	2,523,271	202,433	367,470	461,417	1,031,320	57	
Total.....	3,133,006	527,995	1,144,386	52,129	4,857,497	380,692	543,395	507,321	1,431,407	100	

TOTAL COSTS OF DETAILED FEATURES.

Offices.....	\$331,332	.....	\$69,913	\$2,902	\$404,147	.....	.....	.....	6
Depots.....	206,568	.....	97,978	21,249	325,795	\$29,780	\$27,443	\$14,612	6
Tenders:									
Large.....	236,029	\$68,443	145,459	2,004	451,935	26,717	26,717	24,477	8
Medium.....	584,300	167,658	301,099	6,568	1,058,625	113,347	113,349	3,657	24
Small.....	53,874	16,432	23,238	179	93,724	8,415	8,416	3,157	1
Total.....	874,203	252,533	469,796	7,751	1,604,284	148,479	148,482	31,291	33
Light vessels:									
Exposed.....	204,712	49,246	52,380	507	306,847	23,492	23,492	1,930	5
Moderately exposed.....	132,183	33,305	22,659	1,370	189,521	27,026	27,026	2,537	4
Relief.....	72,900	18,695	22,640	185	114,420	16,098	16,098	.....	2
Lakes.....	60,413	17,348	13,320	398	91,482	5,948	5,949	2,631	2
Total.....	470,208	118,594	110,999	2,460	702,270	72,564	72,565	7,098	13

a Includes offices, except expenses of publications.

b Includes depots and tenders; also item excepted above, charged to supplies.

c Includes light vessels, light stations, minor fixed aids, and buoy.

SUMMARY OF COSTS, LIGHTHOUSE SERVICE, FISCAL YEAR ENDED JUNE 30, 1918—Continued.

TOTAL COSTS OF DETAILED FEATURES—Continued.

Feature.	Maintenance expenses.					Betterment expenses.			Grand total.	Per cent.
	Salaries.	Subsistence.	General supplies.	Incidental expenses.	Total.	Repairs and improvements.		New works.		
						Labor.	Materials and supplies.			
Light stations:										
First order.....	\$125,501	\$19,768	\$33,588	\$1,314	\$180,171	\$5,239	\$8,314	\$6	\$13,712	3
Second order.....	55,882	8,916	18,243	273	83,253	3,050	2,753	16,828	22,641	2
Third order.....	110,481	17,929	38,114	2,787	169,314	14,919	16,312	1,028	32,259	4
Three and one-half order.....	24,407	4,376	6,981	89	35,852	1,307	4,818	.....	6,125	1
Fourth order.....	369,450	64,546	116,022	2,740	552,758	28,645	30,140	253,613	312,798	14
Total.....	685,661	115,535	212,948	7,203	1,021,348	53,323	62,737	271,475	387,535	24
Minor fixed aids:										
Fifth order.....	94,205	17,115	23,251	244	134,844	9,374	6,831	(495)	15,710	2
Sixth order.....	43,644	7,541	11,463	66	62,713	5,004	4,784	50	9,838	1
Lens lanterns.....	67,628	7,400	10,866	489	86,383	5,557	9,539	55,225	70,321	2
Post lights.....	235,901	.....	21,274	1,135	258,311	5,734	13,149	2,398	21,281	4
Other lights.....	123,656	9,277	41,819	4,615	179,367	30,875	57,912	116,769	205,556	6
Daymarks, etc.....	.....	.....	921	570	1,491	1,644	2,082	1,768	5,494	0
Total.....	565,034	41,333	109,624	7,119	723,109	58,188	94,297	175,715	328,200	15
Buoys:										
Lighted.....	.....	.....	41,763	2,128	43,891	11,853	78,615	3,817	94,285	2
Unlighted.....	.....	.....	51,365	1,317	52,682	6,505	59,256	3,312	69,073	1
Total.....	.....	.....	73,128	3,445	76,573	18,358	137,871	7,129	163,358	3
Grand total.....	3,133,006	527,995	1,144,386	52,129	4,857,497	380,692	543,395	507,321	1,431,407	100

SUMMARY OF COSTS, LIGHTHOUSE SERVICE, FISCAL YEAR ENDED JUNE 30, 1918—Con.

AVERAGE COSTS OF SELECTED FEATURES.

Average cost of—	Salaries.	Subsistence.	Illuminants.	Fuel.	Other supplies.	Incidentals.	Total maintenance.	Repairs and improvements.	Total.
District office, exclusive of third	\$12,512				\$1,563	\$74	\$14,148		\$14,148
District depot, exclusive of third	5,879				2,795	674	9,348	\$1,545	10,893
Large tender, Pacific	24,206	\$7,175		\$14,253	5,784	46	51,524	6,300	57,824
Large tender, Atlantic	23,161	6,624		7,315	3,539	303	40,973	4,705	45,678
Medium tender	18,628	5,355		6,128	2,986	176	33,683	7,419	41,102
Exposed light vessel	10,235	2,462	\$80	1,571	967	25	15,340	2,349	17,689
Moderately exposed light vessel	6,294	1,586	85	430	564	65	9,025	2,574	11,599
Lake light vessel	4,647	1,334	32	584	408	31	7,037	914	7,951
First-order light stations with powerful fog signals	2,771	426	123	550	328	32	4,230	355	4,585
First-order light stations without fog signals	1,968	316	84	114	226	21	2,728	202	2,930
Fourth-order light stations with powerful fog signals	1,578	282	65	388	289	18	2,618	265	2,883
Fourth-order light stations without fog signals	770	133	35	55	90	7	1,090	109	1,199
Lens lantern	215	24	15	8	11	1	274	53	327
Minor light, river districts	91		3		3		97	1	98
Minor light, other districts	121		11		6	1	139	29	168
High-pressure acetylene light	42		20		6 6	1	76	b 108	c 184
High-pressure acetylene buoy			24		6 34	2	60	b 54	c 114
Oil-gas buoy			35		a 26	5	66	b 35	c 101

- Figures do not include cost of establishment of new aids.
- Figures include transportation charges of all kinds, such as freight on new buoys, etc.
- Figures do not include renewal of appendages.

APPROPRIATIONS AND EXPENDITURES.

The appropriations for the maintenance of the Lighthouse Service for the fiscal year 1919 were \$6,150,430, exclusive of an allotment of \$175,000 made by the President from the fund for national security and defense, being \$811,750 in excess of those for the preceding fiscal year. The appropriations for special works made for the fiscal year 1919 amounted to \$723,000.

The average appropriations for special works for the 10 preceding years, 1909 to 1918, inclusive, amounted to \$635,133.

The detailed estimates for the fiscal year 1920 are given on page 60. The total amount for general maintenance is \$1,603,200 more than the appropriation for the present year. Particular attention again is invited to the urgent need of the Lighthouse Service for additional funds. The increase in the cost of all materials has continued, salaries and wages have been uniformly advanced, and in order that the Service may be maintained at a proper standard of efficiency a corresponding increase in its appropriations is necessary. The Bureau desires to lay special stress on this matter, and under a separate heading includes a more detailed statement with reference to pay on vessels.

An increase of \$3,420 over the appropriation for the preceding fiscal year is submitted in the estimate for the Bureau of Lighthouses in Washington in order to enable the Bureau to meet the general advance throughout the country in the pay of technical employees, and to keep these positions and the lower paid clerical positions in the Bureau competently filled.

Estimates for 20 special works have been submitted, aggregating \$2,737,775, considering only group 1, of which items amounting to \$1,608,500 are authorized by law. This estimate is \$2,014,775 more than the appropriation for special works for the preceding year, and includes a number of important works for which estimates were submitted last year, but which were not included in the appropriations. The estimates include three new lighthouse tenders, one new light vessel, three new lighthouse depots, four items for establishing or improving aids in general localities, five items for a new system of harbor or channel lights and other aids, one item for establishing a light and fog-signal station, five items for improvement of lighthouse depots, and one item for light-keeper's dwellings.

In selecting and submitting estimates for those special works believed to be most important, there were considered estimates submitted by officers in the various districts and others for new lighthouse and ship construction aggregating about \$4,800,000. Many items not included in the estimates for this year are thought to be meritorious, and the more important of them are included in group 2 of the estimates for special works, submitted for consideration as the resources of the Government permit them to be taken up. Explanation of the necessity for each of the items of special works is included with the estimates.

The tables following give comparisons of appropriations and expenditures for the Lighthouse Service, beginning with the fiscal year 1915 and including the estimates for 1920.

APPROPRIATIONS, LIGHTHOUSE SERVICE, FISCAL YEARS 1915-1918, WITH ESTIMATES FOR 1920.

[The salaries and allowances of officers of the Army on duty with the Lighthouse Service are not included in this table.]

Item.	Appropriations.					Estimates 1920.
	1915	1916	1917	1918	1919	
MAINTENANCE.						
Salaries, Bureau of Lighthouses.....	\$64,030	\$64,030	\$64,030	\$64,030	\$65,430	\$69,030
Salaries of keepers of lighthouses.....	940,000	940,000	940,000	940,000	940,000	1,321,600
General expenses, Lighthouse Service.....	2,775,000	2,775,000	2,790,000	2,850,000	3,500,000	4,000,000
Salaries, lighthouse vessels.....	997,600	1,010,000	1,070,000	1,104,650	1,265,000	1,880,080
Salaries, Lighthouse Service.....	375,000	375,000	375,000	380,000	380,000	433,000
Retired pay, Lighthouse Service.....						50,000
Total for maintenance.....	5,151,630	5,164,030	5,239,030	5,338,680	6,150,430	7,753,630
Unexpended balances (obligations estimated).....	53,424	47,171	67,377			
SPECIAL WORK.						
New light and fog-signal stations.....	63,000		193,000	155,000	80,000	140,000
Light vessels.....				280,000		160,000
Lighthouse tenders.....		250,000	20,000	210,000		600,000
Keepers' dwellings.....						75,000
Improvement of aids.....	50,000		730,000	613,000	355,000	837,775
Lighthouse depots.....	23,000		50,000	21,000	288,000	925,000
Total for special works.....	136,000	250,000	999,000	1,279,300	723,000	2,737,775
Total maintenance and special works.....	5,287,630	5,414,030	6,238,030	6,617,980	6,873,430	10,491,405

EXPENDITURES FROM APPROPRIATIONS, LIGHTHOUSE SERVICE, FISCAL YEARS
1914-1918.

[Actual expenditures, regardless of year of appropriation.]

Expenditures.	1914	1915	1916	1917	1918
For maintenance.....	\$5,166,609	\$5,111,121	\$5,002,706.25	\$5,220,473.07	\$6,246,088.83
For special works.....	538,338	500,516	748,833.50	651,298.99	499,633.24
Total.....	5,704,947	5,611,637	5,751,539.75	5,871,772.06	6,745,722.07

In addition to the appropriations listed above, funds have been received from the Navy Department, or are in course of settlement by transfer, in reimbursement of expenditures and obligations by the Lighthouse Service during the fiscal year 1918, on account of vessels and stations temporarily transferred to that department, and for which the appropriations of the Lighthouse Service were to that extent insufficient, as follows:

To credit of general expenses, Lighthouse Service, 1918.....	\$434,412.13
To credit of salaries, lighthouse vessels, 1918.....	227,564.48
To credit of salaries of keepers of lighthouses, 1918.....	8,233.15
Total.....	670,209.76

Reimbursement for similar reasons was received from the War Department for expenditures and obligations during the fiscal year 1917 on account of vessels temporarily transferred to that department, and omitted from last year's annual report, as follows:

To credit of general expenses, Lighthouse Service, 1917.....	\$68,922.19
To credit of salaries, lighthouse vessels, 1917.....	74,528.73
Total.....	143,450.92

There were no reimbursements for the fiscal year 1917 from the Navy Department, nor for 1918 from the War Department.

DEPOTS.

The Lighthouse Service maintains 39 depots in the various districts for the storage and distribution of supplies and for other purposes. While these depots are not in themselves aids to navigation, they bear such a direct and important relation to the efficient maintenance of the latter that it is essential to provide them with adequate facilities. The sundry civil act of July 1, 1918, appropriated \$85,000 for a depot for the second lighthouse district, and \$90,000 for a depot for the sixteenth lighthouse district, and contained an appropriation of \$53,000 for improvements at the Detroit, Mich., Lighthouse Depot. A number of items for depots are submitted in the estimates, some of which are repeated from previous annual reports, and five of which are authorized by law, though no appropriation has yet been made. Particular attention is invited to these cases, as follows:

In the nineteenth district the headquarters of the Lighthouse Service are at Honolulu, and storage facilities are either rented or granted by the courtesy of other branches of the Government. The establishment of a permanent depot in this district would facilitate the work of the Service, and estimates are submitted for that purpose. The act of August 28, 1916, authorized the construction of a perma-

ment depot at a limit of \$90,000, but no funds were appropriated for this object.

Subsequent to the close of the fiscal year, allotment of \$175,000 from the fund for national security and defense was made by the President on the recommendation of the Secretary of Commerce, for improvements at the general lighthouse depot at Tompkinsville, N. Y., with particular reference to cooperation work with the Navy Department.

In the fifth district the present principal depot at Portsmouth, Va., is inadequate both in area and in water front, considering the size of the district and the number of lighthouse vessels to be accommodated. Estimate is submitted for enlarging this depot or establishing a new one. This work was authorized by the act of June 20, 1918.

The need for a depot at New Orleans, La., in the eighth district, has long been felt, and much unnecessary storage and lighterage expense has been incurred on this account. The Treasury Department has authorized the use of a portion of the United States marine hospital reservation at New Orleans, La., as a site for a lighthouse depot. An estimate for the construction of a depot is submitted. The work was authorized by act of June 20, 1918.

The present depot at Milwaukee, Wis., is practically surrounded by coal yards, and the coal dust is objectionable. Consideration is being given to obtaining a more suitable site.

The act of June 12, 1917, appropriated \$21,000 for improvements of the offices and laboratory at the general depot. Plans and specifications for this work were prepared and bids invited. The bids received were rejected, being in excess of the appropriation.

In the following districts provisions should be made for improved depot facilities:

An estimate is submitted for enlarging the machine shop at the general lighthouse depot at Tompkinsville, N. Y. The present machine shop is so constructed as to be unadaptable for the work it is now called upon to do, and it must be extended to be efficient for the great variety of work at this depot. This work was authorized by act of June 20, 1918, in the sum of \$30,000.

An estimate for improvement of the wharves at the general depot is also submitted, the work having been authorized by act of June 20, 1918, in the sum of \$65,000.

An estimate for a dry dock at the general depot is also submitted in group 2. The congested conditions prevailing at private shipyards and navy yards make it impossible to attend to the docking of lighthouse vessels at the proper intervals. Such a dock also would be of great value to other maritime services of the Department, and it is believed that considerable economy would thus result to the Government as a whole.

In the seventh district at Key West, Fla., the present depot property is on the grounds of the naval station and is surrounded by coal piers. The location is objectionable from the standpoint of caring for lighthouse supplies in a proper manner as well as interfering with the normal growth of the naval station. An estimate for a new depot, to relieve this situation, is submitted.

The new lighthouse depot at Charleston, S. C., for which an appropriation was made by the act of October 22, 1913, has been completed so far as funds permitted and was occupied regularly for the

first time on August 1, 1916. Further improvements at Charleston Depot are needed, for which an estimate is submitted. The present quarters at the Goat Island Lighthouse Depot, Cal., consist of two old frame dwellings, and are inadequate, unsanitary, and poorly arranged. Two families occupy one cottage of seven rooms and three families occupy another cottage of eight rooms. An estimate is submitted for constructing two dwellings of modern design and proper location adjacent to the depot.

By act of July 1, 1918, making appropriations for the naval service for the fiscal year 1919, the lighthouse depot at St. Joseph, Mich., was transferred to the Navy Department for naval purposes. This depot had been occupied by the Navy Department under revocable permit dated June 25, 1917, its use being no longer required for lighthouse purposes.

LIGHTHOUSE TENDERS.

The tenders of the Service have been employed to good advantage during the year. The 51 vessels which have been in commission have steamed a total of about 491,000 nautical miles in their work of supplying light stations, maintaining the buoyage system, transporting construction materials, and carrying the officers and employees of the Service to their stations or on inspection duty.

An appropriation of \$20,000 was made by the act of July 1, 1916, for a light-draft tender and barge for use in establishing and maintaining aids along the intercoastal waterways of Texas and Louisiana. Proposals have been twice advertised for this equipment without results. Therefore it has been necessary to defer action until conditions become more favorable.

With the increase in the number of aids to navigation and the deterioration of older vessels, it will be necessary to construct on an average one or two new tenders each year. The act of June 12, 1917, appropriated \$150,000 to replace the tender *Gardenia*, which has been surveyed and laid up as being of no further use to the Service. Bids received for this work being greatly in excess of the appropriation were rejected.

Estimates have been submitted for new lighthouse tenders to replace the present tenders *John Rodgers*, *Jessamine*, and *Holly*, or for general service, as may be found most desirable, at a cost of \$600,000. The vessels mentioned are all old, unseaworthy, side-wheel steamers, which should be laid up as soon as arrangement can be made. The act of June 20, 1918, authorized this work, but no appropriation has been made.

A working barge for use on the Hudson River was practically completed.

The following tenders have either been extensively overhauled or such work has been started during the fiscal year 1918: *Crocus*, *Arbutus*, *Heather*, *Kukui*, *Larkspur*, *Camellia*, *Holly*, *Magnolia*, *Sumac*, *Woodbine*, and *Snowdrop*.

It is probable that during the current year extensive overhaul will be completed or undertaken on the following tenders: *Mangrove*, *Maple*, *Iris*, *Marigold*, *Amaranth*, *Sunflower*, *Mayflower*, *Mistletoe*, and *Magnolia*.

The following was the number of tenders of the Lighthouse Service on June 30 of the years specified, omitting vessels not having regular

crews and those less than 50 feet in length: 1910, 51; 1911, 46; 1912, 45; 1913, 44; 1914, 45; 1915, 46; 1916, 47; 1917, 51; 1918, 51. On June 30, 1918, the following was the status of the tenders: In actual service, 44; undergoing repairs, 7.

LIGHT VESSELS.

The Lighthouse Service maintains light vessels on 52 stations and has for this purpose 67 light vessels, of which 15 are relief vessels. Some of these vessels are old, 3 having been built over 50 years ago; 8 having been built over 60 years ago; one is 69 years old. Some of the older vessels are in a condition which does not warrant extensive repairs.

The unusual severity of the past winter with the accompanying ice conditions resulted in the total loss of Cross Rip Light Vessel No. 6, Mass., with all on board, consisting of one officer and five men.

On the afternoon of February 4, 1918, a large field of floating ice tore the vessel from her moorings on her station in Vineyard Sound, carrying her seaward, where she disappeared. Every effort was made by Lighthouse Service and Navy vessels to reach the light vessel and render assistance, but without success after several days' search, and the vessel is believed to have foundered. Light vessel No. 45, marking the lower entrance to the 35-foot channel, Chesapeake Bay, Va., was dragged from her station by floating ice on January 5, 1918, and stranded on the Inner Middle Ground Shoal abreast of Fishermans Island, Chesapeake Bay entrance, Va., where she was abandoned by the crew, who reached shore over the ice with difficulty. The vessel was rescued and taken in tow by the tender *Cypress* on January 17, 1918, and brought to Portsmouth, Va., and later to the works of the Colonna Shipbuilding Co., Berkley, Va., for repairs. On March 3, 1918, the vessel was badly damaged by fire, which had its origin on another vessel, berthed near the light vessel. Only the prompt actions of the officers and crew of the light vessel and the fire department saved the vessel from total loss.

A board of survey was ordered, which after a thorough inspection of the vessel on July 10, 1918, submitted a report recommending that the light vessel be condemned and sold, being beyond economical repair, and of no further use to the Government.

During the fiscal year 67 light vessels were in commission. New vessels under construction are light vessels No. 99 and No. 103, for duty on the Great Lakes.

The act of June 20, 1918, authorized \$760,000 for tenders and light vessels, which included a new light vessel for the Gulf coast, but no appropriation was made therefor. An estimate for this object is submitted.

The act of June 12, 1917, appropriated \$130,000 for a light vessel for Cape Charles, Va., or for general service, plans and specifications for which are nearly completed.

The following light vessels have either been extensively overhauled or such work has been started during the last fiscal year: No. 2, No. 13, No. 20, No. 39, No. 49, No. 66, No. 69, No. 80.

It is probable that during the current fiscal year extensive overhaul will be completed or undertaken on the following light vessels: *No. 2, No. 11, No. 16, No. 51, No. 68, No. 70, No. 97.*

The following was the total number of light vessels and stations on June 30 of the years named:

Year.	Light vessels.	Light- vessel stations.	Year.	Light vessels.	Light- vessel stations.
1910.....	68	54	1915.....	66	53
1911.....	53	51	1916.....	66	53
1912.....	65	51	1917.....	68	53
1913.....	67	53	1918.....	67	52
1914.....	66	52			

Of the present light vessels 38 have self-propelling machinery and 27 are provided only with sail power. Two have no means of propulsion.

On June 30, 1918, the following was the status of the light vessels: Regular vessels on station, 41; relief vessels on station, 10; relief vessels at depots, 4; regular vessels under repair, 10; relief vessels under repair, 1; regular vessels laid up, 1; relief vessels laid up, 0.

SALARIES AND WAGES ON LIGHTHOUSE VESSELS.

The greatest difficulty encountered in the efficient maintenance of the service during the past three years has been the question of pay on lighthouse tenders and light vessels. As is well known, abnormal shipping conditions have been created by the European war, and former standard rates of pay on vessels have been completely discarded.

The schedules of pay established from time to time by the United States Shipping Board for officers and crews of vessels, while they do not apply directly to vessels of the Lighthouse Service, are considered standard wages in the localities in which they have been placed in effect, and it has been necessary to adjust the pay of complements of lighthouse vessels to conform therewith as far as appropriations admit, both in justice to employees and in order to keep up a proper efficiency. The wage scale for certain members of deck and engine departments, announced by the Shipping Board on May 18, 1918, for vessels sailing from Atlantic and Gulf ports of the United States is now being paid to crews of lighthouse vessels, and licensed officers were granted increases to meet, as far as possible, new rates authorized in the month of June, 1918, by the Shipping Board for this class of persons. This action has necessitated large increases in the estimates for salaries on vessels of the Lighthouse Service, and estimate for additional increase will be submitted in order to bring the pay of officers of the vessels more nearly up to current rates of pay in the mercantile marine.

REPORT OF OPEN-MARKET PURCHASES.

In compliance with the act of June 17, 1910, there is submitted separately as a part of this report a list of purchases of materials and supplies for the Lighthouse Service made without obtaining bids under public advertisement, with the reasons for so purchasing.

SPECIAL LEGISLATION NEEDED.

The act of June 20, 1918, provides for optional retirement at the age of 65 years, after 30 years of active service, and compulsory retirement at the age of 70 years of all officers and employees engaged in the field service or on vessels of the Lighthouse Service, except persons continuously employed in district offices or shops. This legislation will be of much benefit to the Service, but in order that higher efficiency may be obtained in the administration of the service, retirement provisions should be enacted for the relief of persons included in the above classes who, by reason of disability incident to their work, and distinct from disability caused by injury received in the line of duty, for which compensation is now provided by law, have lost their efficiency for active work before reaching the age, or having the length of service, required under existing law.

A modification of the act of June 20, 1918, is also deemed desirable so far as it requires compulsory retirement at 70 years of age. The Bureau is of the opinion that the interests of the Government would be served more effectively by substituting for compulsory retirement of persons who have reached 70 years of age a provision for the retirement of such persons in the discretion of the Secretary of Commerce.

The Bureau is strongly of the opinion that the interests of the Government would be further benefited, in the attainment of a higher degree of efficiency, as well as in affording justice to deserving employees, by the enactment of legislation providing for a system of general retirement for the civil employees of the Government, including office and shop employees of the Lighthouse Service, the need of such legislation being particularly apparent in the work of this Service.

The statistics as to the various classes of aids to navigation and fuller details on many of the subjects mentioned in this report will be found in the pages following.

Respectfully,

GEORGE R. PUTNAM,
Commissioner of Lighthouses.

TO HON. WILLIAM C. REDFIELD,
Secretary of Commerce.

STATISTICS AND ESTIMATES.

LIST OF OFFICERS OF THE BUREAU OF LIGHTHOUSES AND THE LIGHTHOUSE DISTRICTS.

OFFICERS OF THE BUREAU OF LIGHTHOUSES ON JUNE 30, 1918.

George R. Putnam.....	Commissioner of Lighthouses.
John S. Conway.....	Deputy Commissioner.
H. B. Bowerman.....	Chief Constructing Engineer.
Edward C. Gillette.....	Superintendent of Naval Construction.
Principal Assistant Engineer, Rudolph Zirpel.	
Superintendent on general duty, E. M. Trott.	
Chief Clerk, Thaddeus S. Clark.	
Examiner, Thomas Flood.	

SUPERINTENDENTS OF LIGHTHOUSE DISTRICTS JULY 1, 1917, TO JUNE 30, 1918.

District.	Name.	From—	To—
1st.....	C. E. Sherman.....	July 17, 1911	
2d.....	R. H. Goddard.....	June 27, 1912	
3d.....	J. T. Yates.....	June 20, 1912	
4th.....	T. J. Rout.....	Mar. 1, 1912	
5th.....	H. D. King.....	Jan. 28, 1915	
6th.....	H. L. Beck.....	Jan. 28, 1915	
7th.....	W. W. Demeritt.....	Aug. 22, 1913	
8th.....	B. B. Dorry.....	June 6, 1912	
9th.....	C. A. Lamy.....	Aug. 7, 1912	Jan. 6, 1918
	F. C. Hingsburg.....	Jan. 28, 1918	
10th.....	Roscoe House.....	June 4, 1912	
11th.....	E. L. Woodruff.....	Aug. 19, 1912	
12th.....	L. M. Stoddard.....	Aug. 16, 1912	Apr. 30, 1918
	C. H. Hubbard.....	May 1, 1918	
13th.....	Maj. Gen. A. Mackenzie, U. S. Army, retired.....	May 29, 1917	
14th.....	Col. Lansing H. Beach, Corps of Engineers, U. S. Army.....	Aug. 10, 1915	
15th.....	Lt. Col. C. S. Smith, Corps of Engineers, U. S. Army.....	June 25, 1917	Sept. 17, 1917
	Brig. Gen. Wm. H. Bixby, U. S. Army, retired.....	Sept. 17, 1917	
16th.....	W. C. Dibrell.....	Aug. 22, 1913	
17th.....	Robert Warrack.....	Feb. 1, 1915	
18th.....	H. W. Rhodes.....	July 6, 1912	
19th.....	A. E. Arledge.....	Sept. 3, 1912	

JURISDICTION OF LIGHTHOUSE SERVICE.

The United States Lighthouse Service is charged with the establishment and maintenance of aids to navigation and with all equipment and work incident thereto on the sea and lake coasts of the United States, on the rivers of the United States so far as specifically authorized by law, and on the coasts of all other territory under the jurisdiction of the United States, with the exception of the Philippine Islands and Panama. The total length of coast line and rivers under the United States Lighthouse Service, measured by steps of 3 miles, is approximately 47,300 miles.

LIMITS OF LIGHTHOUSE DISTRICTS AND ADDRESSES OF SUPERINTENDENTS OF LIGHTHOUSES.

District.	Limits of district.	Address of superintendents.
1st.....	Waters of Maine and New Hampshire.....	Y. M. C. A. Building, Portland, Me.
2d.....	Waters of Massachusetts.....	Customhouse, Boston, Mass.
3d.....	Waters of Rhode Island, Connecticut, New York, and New Jersey northward of Cape May.	Tompkinsville, N. Y.
4th.....	Waters of Delaware seacoast and Delaware Bay and River.	Post Office Building, Philadelphia, Pa.
5th.....	Waters of Maryland, Virginia, and North Carolina to and including New River Inlet, N. C.	New Customhouse, Baltimore, Md.
6th.....	From New River Inlet, N. C., to Hillsboro Inlet, Fla.	Old Post Office Building, Charleston, S. C.
7th.....	Waters of Florida from Hillsboro Inlet to Cedar Keys.	Key West, Fla.
8th.....	Waters of Gulf Coast from Cedar Keys, Fla., to mouth of Rio Grande, Tex., and Mississippi River below New Orleans.	Customhouse, New Orleans, La.
9th.....	Waters of Porto Rico and adjacent United States islands.	San Juan, P. R.
10th.....	United States waters of St. Lawrence River and Lakes Ontario and Erie.	Federal Building, Buffalo, N. Y.
11th.....	United States waters of Lakes St. Clair, Huron, and Superior, and Detroit River.	Post Office Building, Detroit, Mich.
12th.....	Waters of Lake Michigan and Green Bay.....	Federal Building, Milwaukee, Wis.
13th.....	Mississippi River above the mouth of the Missouri River, Minnesota, Illinois, Osage, Gasconade, and Missouri Rivers.	Federal Building, Rock Island, Ill.
14th.....	Ohio, Tennessee, Kanawha, and Monongahela Rivers.	Customhouse, Cincinnati, Ohio.
15th.....	Mississippi River below the Missouri River to New Orleans, La., and Red River.	Customhouse, St. Louis, Mo.
16th.....	Waters of Alaska.....	Ketchikan, Alaska.
17th.....	Waters of Washington and Oregon.....	Customhouse, Portland, Oreg.
18th.....	Waters of California.....	Customhouse, San Francisco, Cal.
19th.....	Waters of Hawaiian, Midway, Guam, and American Samoan Islands.	McCandless Building, Honolulu, Hawaii.

LIGHTHOUSE DEPOTS MAINTAINED ON JUNE 30, 1918.

[The principal depot of the district is indicated by the larger type.]

District.	Location.	District.	Location.
1st.....	Bear Island, Me. LITTLE DIAMOND ISLAND, ME.	8th.....	Fort San Jacinto, Galveston, Tex. Mobile, Ala.
2d.....	LOVELLS ISLAND, BOSTON, MASS. Woods Hole, Mass.		PORT EADS, LA.
3d.....	Goat Island, R. I. Juniper Island, Vt. New London, Conn. TOMPKINSVILLE, STATEN ISLAND, N. Y.	9th.....	SAN JUAN, P. R.
4th.....	Tucker Beach, N. J. EDGEMOOR, DEL. Lewes, Del.	10th.....	BUFFALO, N. Y. Erie, Pa.
5th.....	Annapolis, Md. Lazaretto Point, Md. Point Lookout, Md. PORTSMOUTH, VA. Washington Wharf, D. C.		Maumee Bay, Ohio. Rock Island, N. Y.
6th.....	Washington, N. C.	11th.....	Sandusky Bay (Cedar Point), Ohio. DETROIT, MICH.
7th.....	CHARLESTON, S. C. Egmont Key, Fla. KEY WEST, FLA.		Minnesota Point, Minn. St. Marys River, Mich.
		12th.....	Charlevoix, Mich.
			MILWAUKEE, WIS.
		16th.....	KETCHIKAN, ALASKA.
		17th.....	Ediz Hook, Wash.
			TONGUE POINT, OREG.
		18th.....	GOAT ISLAND, CAL.
		19th.....	HONOLULU, HAWAII.

EXPLANATION OF TABLE ON PAGE 27.

The table of aids to navigation includes all those maintained by the Lighthouse Service, a total of 15,673. On page 33 are given facts regarding the private aids to navigation, 777 in number, maintained under authority. In the statistics relief light vessels are not counted and duplicate or auxiliary lights and fog signals are not counted, but double lights are counted separately when maintained on distinct structures or for distinct purposes. Buoys for the purpose of marking the positions of light vessels or larger buoys are not counted. Fog signals at light stations or on vessels are counted as separate aids, but not those attached to buoys, except in the case of submarine bells, which are counted as separate signals, whether on vessels or on buoys. Otherwise each buoy is counted only once, and if it is included in a higher class it is not in the lower class. Light-vessel lights are not counted separately.

[See note on p. 26.]

Class.	1st dist.	2d dist.	3d dist.	4th dist.	5th dist.	6th dist.	7th dist.	8th dist.	9th dist.	10th dist.	11th dist.	12th dist.	13th dist.	14th dist.	15th dist.	16th dist.	17th dist.	18th dist.	19th dist.	Total.
LIGHTED AIDS.																				
Hyper-radiant lights.....																				1
First-order lights.....	2	5	5	2	8	8	6	3									9	9	1	57
Second-order lights.....	7	3	2			2	1	2	1		3	2						1	2	26
Third-order lights.....	6	1	3	3		3	4	8	5	4	10	9				5	2	4	1	68
Three-and-one-half-order lights.....		2	1	3	1	1		3	2	3	6	1								24
Fourth-order lights.....	35	25	58	10	49	2	4	12	5	21	46	38				4	18	20	8	355
Fifth-order lights.....	18	15	18	4	22	3	1	13	3	9	16	13								139
Sixth-order lights.....	1	5	22	2	8	1			5	10	4	16						2	2	73
Range-lens lights.....			9	13	4	9				6	3						2			46
Reflector lights.....	2	7	1	12	16	31	13	7	2	6	27	4					2			130
Lens-lantern lights.....	11	26	58	19	44	64	39	157	14	38	91	47				94	25	37	37	801
Minor lights.....	3	18	170	29	301	175	69	110	5		82	7		567	707	51	268	19	3	3,046
Electric lights without lens.....	1																6	2	1	11
Light-vessel stations.....	1	11	10		8	4		2				6					3	2		52
Gas-lighted buoys.....	6	45	52	12	59	7	5	28	5	32	77	17				5	11	9	6	376
Gas and whistling buoys.....	7	5	11		10	8	5	9	1		1	1				1	6	8		72
Gas and aerial bell buoys.....		10	18	6	19	6	6	2		2	11	18				1	5	5	1	110
Float lights.....									1	22	5	5		40		6				158
Total.....	100	178	438	115	549	323	153	356	49	153	386	184	541	607	707	168	357	118	63	5,545
UNLIGHTED AIDS																				
Lights on fixed aids.....	86	107	347	97	453	298	137	317	42	97	288	137	462	567	707	155	332	94	56	4,779
Lights on floating aids.....	14	71	91	18	96	25	16	39	7	56	98	47	79	40		13	25	24	7	766
Total lighted aids.....	100	178	438	115	549	323	153	356	49	153	386	184	541	607	707	168	357	118	63	5,545
Fog signals, engine power.....	19	21	37	5	15	4		3		9	38	47				10	23	30		261
Fog signals, clock power.....	37	13	59	6	66	3	1	14		5	5	9				1	3	6		228
Fog signals, hand power.....	12	1	2								1	1								17
Fog signals, electric.....		5	4	1	4					1	7						4			30
Submarine signals.....	2	8	9			5		3			5	4				1	4	4		51
Buoys, whistling (unlighted).....	19	11	8		2	6	3	5	1								7	18	2	81
Buoys, bell (unlighted).....	53	37	58		26	7	6	15	4	1	1	3				3	7	16	1	243
Buoys, iron.....	147	67	153	101	265	293	214	168	136	14	26	30				154	134	52	60	2,014
Buoys, spar (wood).....	704	595	885	89	938	6		178		154	489	135	497			41	132	31	8	4,882
Daymarks, beacons, etc.....	177	82	37	1	372	540	225	247	6		3	8	338	62		61	79	27	56	2,321
Total unlighted aids.....	1,170	840	1,252	208	1,696	864	449	633	147	184	575	237	835	62		271	393	186	126	10,128
Grand total.....	1,270	1,018	1,690	323	2,245	1,187	602	989	196	337	961	421	1,376	669	707	439	750	304	189	15,673

DETAILS AS TO LIGHTS ON LIGHT VESSELS.

	1st dist.	2d dist.	3d dist.	5th dist.	6th dist.	8th dist.	11th dist.	12th dist.	17th dist.	18th dist.	Total.
Characteristics as to lights:											
1 fixed white light.....		3	1		1		4	4			13
2 fixed white lights.....		1	3	1		1			2	1	9
1 fixed red light.....								1			1
2 fixed red lights.....		2									2
1 fixed white and 1 fixed red light.....		1		3	1				1		6
1 white flashing, or occulting, and 1 fixed red light.....			2								2
1 white light, flashing or occulting.....	1	3	4	3	1	1	1	1		1	16
1 red light, flashing or occulting.....		1									1
2 white lights, flashing or occulting.....				1	1						2
Illuminants:											
Incandescent oil vapor.....		1			1	1					3
Acetylene.....	1	3	2	3	2						11
Oil (wick).....		6	4	3	1	1	4	5	3	1	28
Oil (wick) and acetylene.....			1	1							2
Oil (wick) and oil gas with mantle.....			1								1
Electric arc.....		1	1								1
Electric incandescent.....		1	1	1			1	1		1	6
Illuminating apparatus:											
Fourth order.....		1			1	1		1			4
Fifth order.....				1							1
Reflector.....		2	3	2	1		2		1		11
Reflector and lens lantern.....			2								2
Lens lantern.....	1	8	5	5	2	1	3	5	2	2	34

DETAILS AS TO FOG SIGNALS.

Kind and how operated.	1st dist.	2d dist.	3d dist.	4th dist.	5th dist.	6th dist.	7th dist.	8th dist.	10th dist.	11th dist.	12th dist.	16th dist.	17th dist.	18th dist.	Total.
Steam:															
Whistle.....	8	5	6		5	2		1	3	31			3	6	100
Siren.....		1	1										1	1	4
Air:															
Whistle.....	1	4			1						5			1	12
Siren.....	2	3	23	1	5	1		1	3	7	10	5	6	16	83
Diaphone.....		1				1			3	1	1	1	2	6	16
Siren (electric).....				1					1	4			1	4	11
Reed horn.....	8	6	7	4	5			1				4	13		48
Submarine bells:															
On light vessels, driven by compressed air.....	1	7	7		7	3		2		3	4		3	2	39
On bottom, electric power.....										2					2
On buoys, operated by sea.....	1	1	2		1	2		1				1	1		10
Bell:															
Clockwork.....	37	13	59	6	66	3	1	14	5	5	9	1	3	5	228
Electric.....		5	4		3					3			1		16
Engine.....		1													1
Hand.....	12	1	2												15
Horn: Hand.....										1	1				2
Total.....	70	48	111	12	93	12	1	20	15	56	61	12	34	42	587

* Auxiliary fog signals (71), whistling buoys (153), and bell buoys (353) are not included.

LIGHTS ESTABLISHED DURING THE FISCAL YEAR 1918.

[204 lights.]

District.	Location.	Order.
2d.....	Canal Channel, Buzzards Bay, Mass. (4 lights).....	Lens lantern (2 acetylene, 2 electric incandescent).
3d.....	Sag Harbor, N. Y.....	Minor.
4th.....	Block Island, Delaware River, N. J.....	Minor (acetylene).
5th.....	Elizabeth River, Southern Branch, Va. (10 lights).....	Minor (5).
	Jones Point Shoal, Rappahannock River, Va.....	Lens lantern (5 electric incandescent).
	T. D. Purnell Wreck, Rappahannock River, Va.....	Minor.
6th.....	Arlington Cut, St. Johns River, Fla. (2 lights).....	Do.
	Fort Fremont, Beaufort River, S. C.....	Lens lantern.
	Mile Point Cut, St. Johns River, Fla. (3 lights).....	Minor.
	Tiger Island Range Front Auxiliary, Cumberland Sound, Fla.	Do.
	White Shells Cut, St. Johns River, Fla. (2 lights).....	Do.
7th.....	Caximbas Pass, Fla.....	Do.
	Miami Harbor, Fla. (17 lights).....	Minor (acetylene).
8th.....	Cypress Range, Mississippi River, La. (2 lights).....	Minor (15).
	East River, Escambia Bay, Fla.....	Minor (1 acetylene).
	Head of Passes, Mississippi River, La. (2 lights).....	Reflector.
	Pass Christian, Miss. (3 lights).....	Minor.
	Spanish River, Mobile River, Ala.....	Do.
	Twelve-Mile Island, Mobile River, Ala.....	Do.
9th.....	Buck Island, Virgin Islands.....	Do.
	Fort Louisa Augusta, St. Croix, Virgin Islands.....	6th (acetylene).
	Frederiksted Harbor, St. Croix, Virgin Islands (2 lights).....	Minor.
	Hams Bluff, St. Croix, Virgin Islands.....	Do.
	Judge Bergs Hill, St. Thomas, Virgin Islands (2 lights).....	4th (incandescent oil vapor).
	Myhlesfeldt Point, St. Thomas, Virgin Islands.....	Reflector.
	Navassa Island, Caribbean Sea.....	5th.
10th.....	Black Rock Channel, Buffalo Harbor, N. Y. (12 float lights).....	4th (incandescent oil vapor).
	Conneaut West Pierhead, Ohio.....	Minor.
11th.....	Blake Point, Lake Superior, Mich.....	Lens lantern.
	Ecorse Channel, Detroit River, Mich. (3 float lights).....	Lens lantern (acetylene).
	Fighting Island, Detroit River, Mich.....	Minor.
	Mud Island Shoal, Detroit River, Mich. (float light).....	Lens lantern (acetylene).
	Sand Hills, Keweenaw Point, Mich.....	Minor.
12th.....	Outer Breakwater, Chicago, Ill.....	Do.
	Racine South Breakwater, Wis.....	Minor (acetylene).
13th.....	19 lights.....	Lens lantern (acetylene).
	9 lighted spars.....	Minor.
	1 float light.....	Do.
14th.....	1 light.....	Do.
	1 float light.....	Do.
15th.....	52 lights.....	Do.
16th.....	Beluga River, Cook Inlet, Alaska.....	Do.
	Black Rock, Revillagigedo Channel, Alaska.....	Lens lantern (acetylene).
	Inner Point, Port Walter, Alaska.....	Minor.
	Kalgin Island, Cook Inlet, Alaska.....	Lens lantern (acetylene).
	Katalla Bay, Alaska.....	Minor.
	Klawak Island, Prince of Wales Island, Alaska.....	Do.
	Klawak Reef, Prince of Wales Island, Alaska.....	Lens lantern (acetylene).
	Middle Ground, Wrangell Strait, Alaska.....	Minor (acetylene).
	Point Crowley, Chatham Strait, Alaska.....	Lens lantern (acetylene).
	Red Bluff Bay, Chatham Strait, Alaska.....	Minor.
	Tonki Cape, Afognak Island, Alaska.....	Lens lantern (acetylene).
17th.....	Apple Cove Point, Puget Sound, Wash.....	Do.
	Blakely Rock, Puget Sound, Wash.....	Minor.
	Cathlamet Charnel, Columbia River (2 lights).....	Do.
	Coffee Island Passage, Columbia River (2 lights).....	Do.
	Dibbles Dike, Columbia River.....	Do.
	Flavel, Columbia River.....	Minor (electric incandescent).
	Henrici Crossing, Columbia River (2 lights).....	Minor.
	Isthmus Slough, Coos Bay, Oreg.....	Do.
	Jetty Sands, Columbia River.....	Do.
	Marshfield Channel, Coos Bay, Oreg. (2 lights).....	Do.
	Pillar Rock Channel, Columbia River.....	Do.
	Salmon Bay, Puget Sound, Wash. (4 lights).....	Minor (3).
	Westport Slough, Columbia River.....	Lens lantern (acetylene).
	Willapa Bay, Wash.....	Minor.
19th.....	Cape Hanamanioa, Maui Island, Hawaii.....	Do.
	Honolulu Harbor, Oahu Island, Hawaii (2 lights).....	Lens lantern (acetylene).
		Lens lantern (electric incandescent).

NOTE.—Light stations in the Virgin Islands were transferred to jurisdiction of Lighthouse Service by Executive order of July 20, 1917.

LIGHTS WHERE ILLUMINATION WAS IMPROVED DURING THE FISCAL YEAR 1918.

FLASHING OR OCCULTING LIGHTS CHANGED FROM FIXED LIGHTS (13 LIGHTS).

District.	Location.	District.	Location.
2d.....	Great Round Shoal Light Vessel, No. 86, Nantucket Sound, Mass.	16th.....	Mary Island, Revillagigedo Channel, Alaska.
4th.....	Penn Manor, Delaware River, Pa.		Sentinel Island, Favorite Channel, Alaska.
	Rehoboth Canal Jetty, Rehoboth Bay, Del.		Southeast Five-Finger Islands, Stephens Passage, Alaska.
8th.....	Galveston Jetty, Galveston Entrance, Tex.	18th.....	Lime Point, San Francisco Harbor, Cal.
10th.....	Charlotte Harbor, N. Y.	19th.....	Alia Point, Hawaii Island, Hawaii.
11th.....	Alpena, Lake Huron, Mich.		Kauhola Point, Hawaii Island, Hawaii.
	Huron Bay, Lake Superior, Mich.		

INCANDESCENT OIL-VAPOR LIGHTS CHANGED FROM OIL-WICK LIGHTS (3 LIGHTS).

4th.....	Finns Point Range Rear, Delaware River, N. J.	19th.....	Kauhola, Hawaii Island, Hawaii.
8th.....	Galveston Jetty, Tex. (from acetylene).		

ACETYLENE OR OTHER LIGHTS CHANGED FROM OIL-WICK LIGHTS, ETC. (41 LIGHTS).

2d.....	Derby Wharf, Salem Harbor, Mass.	10th.....	Manhattan Range, Maumee Bay, Ohio (oil gas to electric incandescent, 2 lights).
	Great Round Shoal Light Vessel, No. 86, Nantucket Sound, Mass.		South Buffalo South Side, Buffalo Harbor, N. Y. (electric incandescent).
	Mishaum Ledge Gas and Bell Buoy, 3, Buzzards Bay, Mass. (from oil gas).	11th.....	Alpena, Lake Huron, Mich. (from electric incandescent).
	Nobska Point Gas Buoy, 18, Vineyard Sound, Mass. (from oil gas).		Fighting Island Channel, Detroit River, Mich. (3 gas buoys from oil gas).
	Pollock Rip Gas Buoy, 2 C, Nantucket Sound, Mass. (from oil gas).		Huron Bay, Lake Superior, Mich.
3d.....	Overfalls Light Vessel, No. 69, seacoast of Delaware (from electric incandescent).	12th.....	Portage Lake Ship Canals East Breakwater, Mich. (from oil gas).
4th.....	Deepwater Range Point Front, Delaware River, N. J. (electric incandescent).		Grand Haven Pierhead, Mich. (electric incandescent).
	Fort Mifflin Bar Cut Range Rear, Delaware River, N. J. (electric incandescent).		Muskegon Pierhead, Mich. (electric incandescent).
	Marcus Hook Range Rear, Delaware River, Del.	16th.....	Sturgeon Bay Bridge, Green Bay, Wis. (electric incandescent).
	Mud Island Range Front, Delaware River, Pa. (electric incandescent).		Mary Island, Revillagigedo Channel, Alaska.
	Penn Manor, Delaware River, Pa.		Sentinel Island, Favorite Channel, Alaska.
	Rehoboth Canal Jetty, Rehoboth Bay, Del.		Southeast Five-Finger Islands, Stephens Passage, Alaska.
	Riverton, N. J. (electric incandescent)	17th.....	Marrowstone Point, Admiralty Inlet, Wash. (electric incandescent from acetylene).
5th.....	Torresdale, Pa. (electric incandescent)	18th.....	Lime Point, San Francisco Harbor, Cal.
	Pooles Island, Chesapeake Bay, Md. (3 lights).	19th.....	Alia Point, Hawaii Island, Hawaii.
	35-Foot Channel, Chesapeake Bay, Va. (4 gas buoys from oil gas).		
10th.....	Charlotte Harbor, N. Y. (electric incandescent, 2 lights).		

LIGHTS DISCONTINUED DURING THE FISCAL YEAR 1918.

[84 lights, including float lights.]

District.	Location.	Order.
4th.....	Biles Island, Delaware River, Pa.	Minor.
	Deadman Shoal, Delaware Bay, N. J.	Minor (acetylene).
5th.....	Tarpley Point Shoal, Rappahannock River, Va.	Minor.
6th.....	Oyster Beds Range, Savannah River, Ga. (2 lights)	Reflector.
	St. Johns River, Fla. (6 lights)	Minor (5).
		Lens lantern (1).
8th.....	Head of Passes, Mississippi River, La. (2 lights)	Minor.
	Mobile Channel, Ala.	Lens lantern (acetylene).
11th.....	West Neebish Channel, St. Marys River, Mich. (2 lights)	Lens lantern (oil gas).
13th.....	12 lights.	Minor.
	9 lighted spar buoys.	Do.
	1 float light.	Do.
14th.....	4 lights.	Do.
15th.....	32 lights.	Do.

LIGHTS DISCONTINUED DURING THE FISCAL YEAR 1918—Continued.

District.	Location.	Order.
16th.....	Katalla Bay, Alaska.....	Minor.
17th.....	Elk Spit, Willapa Bay, Wash.....	Do.
	Porter, Coos Bay, Oreg.....	Do.
	Salmon Bay, Puget Sound, Wash. (2 lights).....	Do.
19th.....	Honolulu Channel, Oahu Island, Hawaii (4 lights).....	Lens lantern.
	Kanahena Point, Maui Island, Hawaii.....	Do.

GAS BUOYS ESTABLISHED AND DISCONTINUED DURING THE FISCAL YEAR 1918.

District.	Location.	District.	Location.
	ESTABLISHED (41).		
2d.....	Canal Channel, Buzzards Bay, Mass.	17th.....	Tongue Point Crossing, Columbia River.
	Great Ledge, Woods Hole, Mass.	18th.....	New York Slough (bell), Suisun Bay, Cal.
	Mosher Lodge (bell), Buzzards Bay, Mass.	19th.....	Waihee Reef, Kahului Harbor, Hawaii.
	West Island Shoal, Buzzards Bay, Mass.		DISCONTINUED (28).
3d.....	Coal Barge Wreck, seacoast, N. J.	2d.....	Canal Channel, Buzzards Bay, Mass.
	Coal Barge Wreck, Lower Bay, N. Y.		South Channel, Boston Harbor, Mass.
	Hampshire Wreck, seacoast, N. J.	3d.....	Coal Barge Wreck, seacoast, N. J.
	Henry Failing Wreck, seacoast, R. I.		Coal Barge Wreck, Lower Bay, N. Y.
	Mudscow V 5 Wreck, Lower Bay, N. Y.		Hampshire Wreck, seacoast, N. J.
	Wreck, Lower Bay, N. Y.		Henry Failing Wreck, seacoast, R. I.
4th.....	Orleans Wreck (bell), seacoast, Del		Mudscow V 5 Wreck, Lower Bay, N. Y.
5th.....	Cherubim Wreck, Chesapeake Bay, Va.	4th.....	Bulkhead Shoal Channel, Delaware River, Del. (2).
	Derrick Wreck, James River, Va.	5th.....	James A. Garfield Wreck, Chesapeake Bay, Md.
	Georgia Wreck, seacoast, Va.		Powhattan Wreck, Hampton Roads, Va. (2, 1 a bell).
	Haubage Wreck, seacoast, Va.		35-Foot Channel, Chesapeake Bay, Va.
	James A. Garfield Wreck, Chesapeake Bay, Md.	9th.....	San Augustin Shoal, San Juan, P. R.
	Newport News North Channel, Va. (2).	10th.....	Point Peninsula, Lake Ontario, N. Y.
	North River Entrance (bell), Albemarle Sound, N. C.	11th.....	Bar Point Channel, Detroit River, Mich.
	Thimble Shoal Dredged Channel, Va. (4 including 2 bell).		Blake Point, Lake Superior, Mich. (bell).
	Scow Wreck, Hampton Roads, Va.		Eagle River Shoal, Lake Superior, Mich. (bell).
6th.....	35-Foot Channel, Chesapeake Bay, Va.		Fighting Island Channel, Detroit River, Mich.
8th.....	Second Cut, Savannah River, Ga.		Pointe aux Barques, Lake Huron, Mich. (whistle).
	Mobile Channel, Mobile Bay, Ala.		Rains Island Shoal, St. Marys River, Mich.
	Navy Yard Outer Bank, Pensacola, Fla. (bell).		Vidal Shoals, St. Marys River, Canada.
10th.....	Stony Island, Lake Ontario, N. Y.		West Neebish Channel, St. Marys River, Mich.
	Strawberry Island Cut, Niagara River, N. Y.	12th.....	North Bank, Indiana Harbor, Ill.
11th.....	Fighting Island Channel, Detroit River, Mich.		Waukegan Shoals, Lake Michigan, Ill. (bell).
	Pointe aux Barques (bell), Lake Huron, Mich.	16th.....	Helm Rock, Sumner Strait, Alaska (bell).
	Watson Reefs, St. Marys River, Mich.	17th.....	Tongue Point Crossing, Columbia River.
	West Neebish Channel (2), St. Marys River, Mich.		
12th.....	Waukegan Shoals, Lake Michigan, Ill.		
16th.....	Helm Rock (bell), Sumner Strait, Alaska.		
17th.....	Elk Spit, Willapa Bay, Wash.		

FOG SIGNALS IMPROVED AND DISCONTINUED DURING THE FISCAL YEAR 1918.

District.	Location.	Character.
	IMPROVED (4).	
2d.....	Wings Neck, Buzzards Bay, Mass.....	From— Bell operated by machinery. To— 1st-class reed horn.
17th.....	Marrowstone Point, Admiralty Inlet, Wash.	Acetylene gun, and bell operated by machinery. 3d-class reed horn.
18th.....	Oakland Harbor, Cal.....	Bell operated by machinery. Air diaphone.
	Southampton Shoal, San Francisco Bay, Cal.	Do. Do.
	DISCONTINUED (1).	
10th.....	Buffalo Light Vessel, No. 98, Lake Erie, N. Y.	1st-class air siren.

LIGHT VESSELS DISCONTINUED DURING THE FISCAL YEAR 1918.

District.	Number of vessel	Name of station.
19th.....	98	Buffalo Approach, N. Y.

PRIVATE AIDS TO NAVIGATION MAINTAINED ON JUNE 30, 1918.

[Under the act of June 20, 1906.]

District.	Lights	Buoys.		Other un-lighted aids.	Fog signals.	Total.
		Lighted.	Unlighted			
1st.....	1		32			36
2d.....	41		20	12		82
3d.....	29	3	93	7	2	134
4th.....			7			7
5th.....	115	9	125	60	3	212
6th.....			1			1
7th.....	3		9	2		15
8th.....	12		20	8		40
9th.....			2			2
10th.....	24	3	2	1	1	31
11th.....	13	13	54	1		81
12th.....	30	3	8		7	48
13th.....		1				1
15th.....	1					1
16th.....	2		1			3
17th.....	2		14		2	18
18th.....	23	2	6	1	10	42
19th.....	20		3			23
Total.....	217	34	106	95	25	777

BRIDGES OVER NAVIGABLE WATERS LIGHTED ON JUNE 30, 1918.

[Under the act of Aug. 7, 1882, 22 Stat., 309.]

District.	Lighted bridges.	District.	Lighted bridges.	District.	Lighted bridges.
1st.....	22	8th.....	261	15th.....	8
2d.....	63	9th.....	1	17th.....	55
3d.....	195	10th.....	58	18th.....	29
4th.....	17	11th.....	53		
5th.....	155	12th.....	167	Total.....	1, 132
6th.....	58	13th.....	80		
7th.....	24	14th.....	186		

AIDS MAINTAINED UNDER CONTRACT DURING FISCAL YEAR 1918.

District.	Name of aids.	Annual cost.
1st.....	Kennebunkport Pier Light, Me.....	\$150.00
7th.....	Caximbas Pass and Big Marco Pass, Fla. (4 buoys).....	72.00
9th.....	Christiansted Harbor, St. Croix, V. I. (10 buoys).....	480.00
10th.....	Lake Ontario and the St. Lawrence River, N. Y. (41 buoys).....	2,500.00
	Niagara River and Black Rock Channel, N. Y. (75 buoys).....	984.50
11th.....	Superior Bay, St. Louis Bay and River, Wis. and Minn. (32 lights).....	1,980.00
12th.....	Fox River, Wis. (14 spar buoys); Green Bay, Wis. (18 spar and 2 gas buoys).....	200.00
16th.....	St. Michael Canal and Apoon Pass, Alaska (32 buoys), and Orizaba Reef Bell Buoy..	428.50
	Norton Sound (11 lights).....	680.00
18th.....	Hookton Channel Range Rear Light, Cal.....	1.00

LIGHT VESSELS IN COMMISSION DURING THE FISCAL YEAR, 1918.

Number.	Station.	District.	Tonnage.		When built.	Material of hull.	Dimensions.			Indicated horsepower (self-propelling).	Regular complement.		Fog signal.	Illuminant.	Cost of repairs made during fiscal year.	Cost of maintenance during fiscal year.	Original cost.	On station.	
			Gross.	Net.			Length over all.	Breadth.	Depth.		Officers.	Crew.						Months.	Days.
74	Portland, Me.	1	495		1892	Wood	129 9	28 6	13 0	380	4	8	12" steam whistle b.	Acet.	\$2,411	\$1,356	\$88,896	12	...
3	Handkerchief, Mass.	2	140		1852	do.	69 4	23 0	10 0	(d)	2	5	Bell	do.	932	6,427	12,000	10	14
4	Relief	2	104		1855	do.	77 0	20 0	10 0	(d)	1	0	Bell or horn	Oil	23	2,427	...	4	26
5	Stone Horse Shoal, Mass.	2	104		1861	do.	80 6	21 6	9 0	(d)	2	7	8" air whistle	do.	769	8,330	...	12	...
20	Cross Rip, Mass.	2	165		1867	do.	81 6	21 6	10 0	(d)	2	5	Bell	Acet.	4,141	1,700	25,040	1	9
9	Hedge Fence, Mass.	2	104		1857	do.	81 6	21 6	10 0	(d)	2	7	8" air whistle b.	Oil	59	8,482	19,853	11	27
41	Vineyard Sound, Mass.	2	387		1876	do.	120 6	26 9	11 0	(d)	2	7	First-class air siren b.	do.	314	8,478	33,000	12	...
42	Hen and Chickens, Mass.	2	410		1877	do.	121 7	26 6	10 6	(d)	3	7	10" air whistle	do.	342	10,172	40,796	12	...
47	Follock Rip, Mass.	2	470		1891	Comp.	120 10	26 6	11 0	(d)	4	4	12" steam chime wh. b.	do.	57	10,224	60,000	11	18
54	Roston, Mass.	2	310		1892	Steel	118 10	26 0	11 0	150	4	7	First-class air siren b.	Inc. o. v.	943	12,456	62,030	11	24
66	Relief	2	500		1896	Comp.	123 0	28 6	13 0	350	2	6	12" steam chime wh. b.	Acet.	4,780	10,563	69,282	4	19
73	Follock Rip Shoal, Mass.	2	538		1901	Steel	123 9	28 6	12 9	400	4	8	do.	Oil	245	13,283	79,872	10	...
85	Nantucket Shoals, Mass.	2	683	246	1907	do.	135 5	29 0	13 0	380	5	10	do. b.	El. inc.	514	16,831	99,000	7	23
86	Great Round Shoal, Mass.	2	683	246	1907	do.	135 5	29 0	13 0	380	4	8	do. b.	Oil	666	13,508	99,000	11	28
90	Relief	2	685	225	1908	do.	135 5	29 6	13 0	400	2	4	do. b.	do.	2,793	10,704	107,213	8	17
11	Scotland, N. J.	3	320		1853	Wood	104 0	24 8	11 6	(d)	2	5	Bell	Oil and oil gas.	2,289	6,979	13,462	10	6
13	Bartlett Reef, Conn.	3	155		1854	do.	79 8	21 8	10 4	(d)	4	5	do.	Oil	7,173	7,793	12,000	6	13
16	Relief	3	250		1854	do.	103 6	22 6	11 0	(d)	1	1	First-class air siren, 6" whistle. b.	do.	1,623	1,934	28,084	10	11
23	Ram Island Reef, Conn.	3	186		1857	do.	94 2	24 0	9 0	(d)	2	5	10" air	do.	250	6,862	7,500	11	5
39	Brenton Reef, R. I.	3	387		1875	do.	119 6	26 9	13 0	(d)	4	6	Wh. b.	do.	23,726	11,278	42,200	5	13
44	Northeast End, N. J.	3	197		1882	Iron	115 6	25 0	10 6	(d)	4	7	First-class steam siren b.	Acet.	970	11,063	50,000	10	28
48	Cornfield Point, Conn.	3	470		1891	Comp.	120 10	27 8	12 0	(d)	4	6	do.	Acet. and oil.	1,248	10,907	52,780	8	17
51	Relief	3	283		1892	Iron	118 10	26 9	11 0	135	2	6	12" steam whistle b.	El. inc.	6,800	5,990	53,325	4	21
68	Fire Island, N. Y.	3	390	204	1897	Comp.	122 10	26 6	12 6	350	4	10	12" steam chime wh. b.	do.	6,967	44,495	74,750	10	28
69	Overfalls, Del.	3	590	204	1897	do.	122 10	26 6	13 0	350	4	10	do. b.	do.	4,206	15,173	79,500	8	23
78	Relief	3	683	188	1904	Steel	129 0	28 6	12 6	325	2	6	12" steam whistle b.	Oil or acet.	1,971	8,512	89,030	6	29
79	Five-Fathom Bank, N. J.	3	668	188	1904	do.	129 0	28 6	12 6	325	4	8	12" steam chime wh. b.	Oil	2,028	13,056	89,000	11	6
87	Ambrose Channel, N. Y.	3	683	246	1907	do.	135 5	29 0	13 0	325	4	10	12" steam whistle b.	E. arc.	2,519	16,936	99,000	11	1
2	Relief	5	210		1819	Wood	98 0	25 0	9 0	(d)	1	5	Bell	Oil	197	1,545	12,402	1	12

	45	46	49	52	71	72	80	91	97	101		133	14	23
Thirty-Five Foot Channel, Va.														
Tail of the Horseshoe, Va.	5	5	5	5	5	5	5	5	5	5	58,500	6,585	58,500	23
Relief.	1887	1887	1887	1887	1887	1887	1887	1887	1887	1887	4,976	10,915	60,000	11
Fenwick Island Shoal, Del.	5	5	5	5	5	5	5	5	5	5	2,444	13,756	57,900	0
Diamond Shoal, N. C.	5	5	5	5	5	5	5	5	5	5	2,382	15,961	70,700	10
Relief.	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	5,413	17,418	89,000	10
Cape Lookout Shoals, N. C.	5	5	5	5	5	5	5	5	5	5	5,413	14,879	83,000	3
Winter quarter Shoal, Va.	5	5	5	5	5	5	5	5	5	5	1,122	16,644	107,213	21
Bush Bluff, Va.	5	5	5	5	5	5	5	5	5	5	189	2,864	.....	24
Cape Charles, Va.	5	5	5	5	5	5	5	5	5	5	1,653	11,762	108,507	28
Martins Industry, S. C.	6	6	6	6	6	6	6	6	6	6	398	9,849	.....	17
Charleston, S. C.	6	6	6	6	6	6	6	6	6	6	1,973	8,478	48,000	25
Relief.	1892	1892	1892	1892	1892	1892	1892	1892	1892	1892	2,703	23,441	61,538	6
Brunswick, Ga.	6	6	6	6	6	6	6	6	6	6	3,714	10,925	99,000	21
Frying Pan Shoals, N. C.	6	6	6	6	6	6	6	6	6	6	102	14,028	104,604	18
Relief.	1881	1881	1881	1881	1881	1881	1881	1881	1881	1881	6	1,007	50,000	.....
Herald Bank, Tex.	8	8	8	8	8	8	8	8	8	8	3,926	13,511	90,000	18
Southwest Pass, La.	8	8	8	8	8	8	8	8	8	8	2,062	12,953	110,065	5
Lake Huron, Mich.	11	11	11	11	11	11	11	11	11	11	2,892	5,945	14,098	12
Bar Point Shoal, Mich.	11	11	11	11	11	11	11	11	11	11	1,235	5,872	14,098	7
Lake St. Clair, Mich.	11	11	11	11	11	11	11	11	11	11	1,737	3,960	14,998	8
Relief.	1912	1912	1912	1912	1912	1912	1912	1912	1912	1912	1,442	8,450	42,910	27
Martin Reef, Mich.	11	11	11	11	11	11	11	11	11	11	3,325	7,766	37,500	3
Poe Reef, Mich.	11	11	11	11	11	11	11	11	11	11	182	7,017	71,292	3
Lansing Shoal, Mich.	12	12	12	12	12	12	12	12	12	12	1,588	7,344	13,600	10
North Manitou Shoal, Mich.	12	12	12	12	12	12	12	12	12	12	1,506	7,071	13,600	7
Grays Reef, Mich.	12	12	12	12	12	12	12	12	12	12	416	7,238	13,600	14
Eleven-Foot Shoal, Mich.	12	12	12	12	12	12	12	12	12	12	1,144	5,925	13,990	11
Peshigo Reef, Wis.	12	12	12	12	12	12	12	12	12	12	416	5,089	13,950	.....
Milwaukee, Wis.	12	12	12	12	12	12	12	12	12	12	299	12,091	74,558	3
Relief.	1915	1915	1915	1915	1915	1915	1915	1915	1915	1915	1,164	7,704	87,025	27
Unatilla Reef, Wash.	17	17	17	17	17	17	17	17	17	17	5,684	19,972	69,750	13
Columbia River, Oreg.	17	17	17	17	17	17	17	17	17	17	2,551	14,894	90,000	8
Relief.	1908	1908	1908	1908	1908	1908	1908	1908	1908	1908	3,040	14,752	107,213	24
Swiftsure Bank, Wash.	17	17	17	17	17	17	17	17	17	17	767	18,420	107,213	9
San Francisco, Cal.	18	18	18	18	18	18	18	18	18	18	2,347	19,479	79,000	20
Relief.	1904	1904	1904	1904	1904	1904	1904	1904	1904	1904	5,922	17,235	90,000	7
Blunts Reef, Cal.	18	18	18	18	18	18	18	18	18	18	3,290	16,231	90,000	17

^a Displacement (salt water). ^d Sail. ^e Displacement (fresh water).
^b Submarine signal. ^e Wood sheathed. ^f Sunk Aug. 6, 1918, by an enemy submarine.
^c Length between perpendiculars. ^f No means of propulsion. ^g Replaced light vessel No. 6 which was lost February 4, 1918.
^h Partially destroyed by fire on March 3, 1918, Condemned by board of survey July 10, 1918.

TENDERS OF LIGHTHOUSE SERVICE IN COMMISSION DURING THE FISCAL YEAR 1918.

Name	Length	Beam	Draft	Description	Material of hull	Dimensions			Mean draft		Tonnage	Regular crew	Miles steamed	Coal consumed (in all)	Cost of repairs	Cost of maintenance	Original cost
						Length	Breadth	Depth	Light	Water							
						Feet	Feet	Feet	Ft. in	Ft. in							
Huron	1	815	1,081	1908	Steamer, single screw	190	29	16	11	0	1,000	6	12,803	1,967	\$6,679	\$42,845	\$184,016
Zodiac	1	773	645	1888	do	163	27	12	8	9	650	5	12,650	1,089	2,088	34,330	48,750
Aurora	2	815	1,053	1908	do	190	30	16	11	0	1,000	6	11,175	1,654	1,899	47,073	191,989
Arcton	2	810	946	1871	Steamer, single screw	191	26	12	6	0	400	5	11,379	685	6,215	31,882	79,792
Maple	2	660	948	1897	Steamer, twin screw	191	30	12	7	5	1,500	5	10,155	1,421	2,326	39,510	74,872
Ida	3	61	84	1892	Steamer, single screw	80	11	5	4	0	60	2	6,210	137	2,104	8,399	6,509
Carleton	3	217	245	1879	do	217	29	9	6	0	200	4	6,648	702	2,820	26,086	50,987
John Rodolph	3	455	571	1882	Steamer, side wheel	160	25	9	6	6	200	4	12,644	2,162	3,877	33,462	123,259
Black put	3	738	888	1903	Steamer, twin screw	199	30	14	9	1	750	6	7,079	654	939	25,954	45,833
Mistletoe	3	455	476	1872	Steamer, side wheel	160	25	9	6	9	370	4	5,295	684	8,906	26,589	48,739
Pansy	3	431	454	1878	Steamer, twin screw	152	25	11	7	7	250	4	19,783	2,155	6,967	14,495	191,638
Tulip	3	774	1,142	1908	do	190	30	16	10	7	1,000	6	18,304	1,051	2,516	26,491	44,500
Myrtle	3	435	542	1872	Steamer, single screw	140	25	11	9	6	225	4	11,067	1,308	67	30,969	84,407
Iris	4	519	609	1897	do	153	30	10	8	7	800	5	5,280	10,593	137	11,296	24,728
Woodbine	4	85	107	1913	Gasoline, single screw	95	16	7	5	2	125	2	17,187	1,159	8,806	31,968	58,288
Columbine	5	429	643	1892	Steamer, single screw	155	27	15	9	6	800	6	7,781	834	1,706	35,518	49,769
Arbutus	5	398	545	1879	Steamer, twin screw	153	25	11	7	1	360	6	6,074	657	11,493	27,310	41,911
Holly	5	431	489	1881	Steamer, side wheel	176	24	10	7	0	400	5	5,092	500	5,475	25,033	41,911
Jessamine	5	369	403	1881	do	156	24	10	7	3	350	4	6,586	422	7,244	14,707	20,425
Juniper	5	125	146	1903	Steamer, twin screw	95	18	8	4	6	200	2	11,196	482	1,256	19,586	55,502
Laurel	5	218	299	1915	Steamer, single screw	105	22	9	6	1	160	4	12,504	1,025	3,301	41,819	93,889
Maple	5	567	799	1893	Steamer, twin screw	164	30	12	7	3	650	6	13,019	1,854	8,783	42,705	186,151
Orchid	5	818	1,081	1908	do	190	30	16	11	0	1,000	6	19,268	2,583	3,738	49,489	191,633
Cypress	6	790	1,080	1908	do	190	30	16	10	9	1,000	7	11,555	2,236	17,001	41,437	74,998
Mangrove	6	606	821	1897	do	164	30	12	7	6	550	5					

Palmetto.....	6	156	170	1917	Gasoline, twin screw.....	do.....	90	22	8	3	8	4	4	0	150	4	8	5,785	{ 12,777 4 }	{ 1,929 276 }	17,554	27,687
Water Lily.....	6	29	39	1895	.....do.....	Wood.	64	11	5	2	11	3	8	36	2	2	6,064	{ 3,790 }		6,055	9,261
Ivy.....	7	736	916	1904	Steamer twin screw.....	Steel.....	173	30	13	8	5	9	6	700	5	24	10,202	1,548	2,393	56,169	123,860	
Snowdrop.....	7	30	41	1896	Gasoline, twin screw.....	Wood.....	69	11	5	2	10	3	7	32	2	2	2,055	1,762	1,846	5,472	9,700	
Camellia.....	8	276	377	1911	Steamer, twin screw.....	Steel.....	117	24	10	5	10	7	7	280	4	17	4,984	684	2,654	27,285	57,412	
Magnolia.....	8	685	877	1904	.....do.....	do.....	173	30	13	7	6	9	2	700	5	24	9,850	1,534	13,601	41,012	124,974
Sunflower.....	8	806	1,246	1907	.....do.....	do.....	174	31	15	10	5	14	6	900	6	26	14,000	2,039	123	24,289	124,958
Lilac.....	9	542	582	1892	Steamer, single screw.....	do.....	155	27	15	11	0	11	6	800	5	19	10,004	946	2,355	42,463	92,125	
Crocus.....	10	681	1,035	1904	Steamer, twin screw.....	do.....	165	29	14	9	6	12	3	700	5	23	6,541	1,255	72,486	38,300	119,718	
Amaranth.....	11	597	975	1892	Steamer, single screw.....	do.....	166	28	14	8	6	12	6	672	5	20	10,086	1,297	2,631	35,067	74,994	
Aspen.....	11	633	945	1906	.....do.....	do.....	126	25	12	7	3	8	3	440	4	10	5,975	509	1,707	18,027	70,573
Clover.....	11	663	1,205	1899	.....do.....	Wood.....	93	22	7	5	4	6	4	140	4	8	9,462	392	775	15,683	84,571
Marigold.....	11	477	696	1890	.....do.....	Iron.....	160	27	12	8	5	11	0	550	5	20	10,859	1,029	24,545	34,499	84,571
Hyacinth.....	12	493	914	1903	.....do.....	Steel.....	165	28	14	7	0	11	6	878	5	21	8,889	1,247	2,862	27,517	115,000
Sumac.....	12	600	887	1903	Steamer, twin screw.....	do.....	169	30	13	8	10	11	9	700	5	23	7,638	1,536	8,292	42,127	114,992	
Dandelion.....	13	232	302	1895	Steamer, stern wheel.....	Wood.....	110	33	5	2	6	3	3	500	4	15	8,589	1,273	4,597	24,415	25,174	
Goldenrod #.....	14	494	725	1888	.....do.....	Steel.....	160	27	4	2	5	3	4	152	.....	.....	.....	.....	1,830	7,904	33,221
Oleander.....	15	463	548	1903	.....do.....	do.....	189	34	7	3	10	4	6	600	3	17	14,116	2,497	851	31,156	60,000
Fern.....	16	245	317	1915	Steamer, single screw.....	Wood.....	112	22	10	1	8	6	6	300	4	11	11,343	2,457	451	27,204	62,100	
Cedar.....	16	1,245	1,970	1917	.....do.....	Steel.....	201	36	18	9	6	14	0	1,150	8	23	12,380	11,102	3,103	70,750	248,189
Heather.....	17	631	831	1903	.....do.....	do.....	179	28	15	9	6	11	6	685	7	19	7,051	750	65,054	35,015	118,508
Manzanita.....	17	774	1,000	1908	Steamer, twin screw.....	do.....	190	30	16	10	7	12	7	1,000	7	23	10,256	1,297	756	38,509	211,817	
Rose.....	17	395	567	1916	.....do.....	do.....	127	24	11	7	0	9	4	330	4	16	8,234	13,576	3,429	3,186	92,125
Madrona.....	18	654	806	1885	Steamer, single screw.....	Iron.....	180	27	15	9	9	11	6	750	6	19	8,506	1,084	8,372	29,889	87,872	
Sequoia.....	18	809	1,100	1908	Steamer, twin screw.....	Steel.....	180	30	16	10	11	13	5	1,000	7	23	11,600	1,317	3,672	36,024	213,479	
Kukul.....	19	838	935	1908	.....do.....	do.....	180	30	16	11	2	12	0	1,000	7	23	12,112	1,945	17,670	60,763	213,880

^a Light—without cargo and deck loads, and a minimum supply of stores, provisions, water, and coal or oil.

^b Loaded—bunkers or fuel-oil tanks full of coal or oil, all tanks, including trimming tanks, full of water, full stores and provisions, and an average maximum cargo and deck load.

^c Transferred to Navy Department.

^d Length between perpendiculars.

^e Gallons gasoline.

^f Displacement (fresh water).

^g Operated by U. S. Engineer Department.

^h Barrels of fuel oil. 1 barrel=42 gallons.

CONSTRUCTION OF TENDERS AND LIGHT VESSELS.

Tender "Aster" and barge.—The act of July 1, 1916, appropriated \$20,000 for constructing or purchasing and equipping a small tender and barge for the eighth district, Texas and Louisiana. It was proposed to purchase a suitable vessel for a tender, and construct the barge from plans and specifications now in preparation. Bids were twice invited for the purchase of a suitable vessel, without satisfactory results owing to the scarcity of vessels caused by war conditions. It is proposed to invite bids again when conditions become more normal. Amount expended to June 30, 1918, \$13.14.

Power derrick barge.—The act of July 1, 1916, appropriated \$100,000 for aids to navigation, Hudson River, N. Y. It was found that in the construction of these aids a light-draft power barge with derrick was required. A suitable barge available for purchase could not be found, and accordingly plans and specifications were prepared for a wooden power derrick barge, and on January 13, 1917, a contract was awarded to Rice Bros., East Boothbay, Me., for the construction of the hull, in the sum of \$29,400. The keel, stem, sternpost, and frames were partly completed when, on July 10, 1917, a disastrous fire occurred at the plant of the above concern, destroying all but four frames, the keel, stem, and sternpost being uninjured.

New material was immediately procured and reconstruction commenced. The vessel was launched on June 5, 1918, and completed and delivered on July 23, 1918, ready for the installation of the propelling machinery and auxiliaries by the Government. Amount expended to June 30, 1918, \$1,277.79.

Tender "Oak."—The act of June 12, 1917, appropriated \$150,000 for a lighthouse tender for the third district to replace the tender *Gardenia* or for general service. Plans and specifications are in preparation, but no expenditures were made to June 30, 1917.

Specifications were prepared and bids invited for the construction of the vessel. The lowest bid received being greatly in excess of the appropriations, all were rejected. It is proposed to again invite bids when additional funds can be made available to meet the increased costs of production under the present abnormal conditions. Amount expended to June 30, 1918, \$7,237.

Light vessel "No. 99."—The act of August 24, 1912, appropriated \$130,000 for a light vessel for general service. Plans and specifications were prepared for a light vessel for the Great Lakes. Bids were received on May 25, 1916, and on June 29, 1916, a contract was awarded to Rice Bros., East Boothbay, Me., in the sum of \$61,000. Amount expended to June 30, 1917, \$28,329.42. The construction of the vessel had reached a degree of completion of approximately 53 per cent on June 30, 1917. On July 10, 1917, a disastrous fire occurred at the builders' plant in which the vessel and the greater part of its fittings were rendered a total loss.

The contractors took prompt steps to procure new material and the construction of a new vessel, a duplicate of the one destroyed, was commenced. On June 30, 1918, the work had reached a degree of completion of approximately 18 per cent. Amount expended to June 30, 1918, \$33,221.03.

Light vessel "No. 100."—Plans and specifications are in preparation for a large light vessel for station at Nantucket Shoals, Mass. There is a balance of approximately \$51,600 remaining under the appropriation of August 26, 1912, for light vessels, but the construction of this vessel from the available balance will not be possible until additional funds are available to meet the higher costs of production caused by the present abnormal conditions. No expenditures were made to June 30, 1918.

Light vessels "No. 103" and "No. 104."—The act of June 12, 1917, appropriated \$150,000 for light vessels for general lake service. Plans and specifications for two vessels similar in construction to light vessel No. 99 have been completed. Bids were received for the construction of one or both vessels, on January 15, 1918, and on June 5, 1918, a contract was awarded to the Gas Engine & Power Co. and Charles L. Seabury Co., Morris Heights, N. Y., in the sum of \$147,428 for the construction of one vessel, No. 103. It is proposed to invite new bids for light vessel No. 104 when funds are available. Amount expended to June 30, 1918, \$112.22.

Light vessel "No. 105" (Cape Charles).—The act of June 12, 1917, appropriated \$130,000 for a light vessel for Cape Charles, Va., or for general service.

Plans and specifications are nearly completed for a large first-class light vessel for this station. No expenditures were made to June 30, 1918.

SPECIAL WORKS OF CONSTRUCTION COMPLETED (OMITTING VESSELS).

SECOND DISTRICT.

Cape Cod Canal Lights, Mass.—The act of August 1, 1914, appropriated \$50,000 for lighting approaches to Cape Cod Canal, Mass. At eastern entrance, Sandwich, Cape Cod Bay, 1 acetylene high-power gas and bell buoy, 1 Pintsch gas and bell buoy, 1 spar buoy, 1 electric lighted lens lantern on tower located on breakwater 900 feet from outer end; at western entrance, Buzzards Bay, 3 acetylene-gas and bell buoys, and 3 acetylene-gas buoys, 14 acetylene-lighted beacons, 1 first-class can, 1 first-class nun, and 6 spar buoys were established. The candlepower of Wings Neck Light was increased from 180 to 2,900 by installation of fourth-order lens and vapor oil apparatus. Internal-combustion engines and air compressors in duplicate for operating Daboll trumpet have been installed at Wings Neck in place of bell operated by clockwork. Amount expended to June 30, 1918, \$50,624.84.

NINTH DISTRICT.

Navassa Island Light Station, W. I.—The act of October 22, 1913, appropriated \$125,000 for the construction of a light station on Navassa Island located in Windward Passage, 40 miles west of Haiti, West Indies. The construction work was started in January, 1916, and the light went into commission October 21, 1917. The tower is of reinforced concrete 150 feet high and dwelling of reinforced concrete with accommodations for three keepers. Amount expended to June 30, 1918, \$116,159.40.

TENTH DISTRICT.

Ashtabula Harbor, Ohio.—The act of October 22, 1913, appropriated \$45,000 for rearranging, rebuilding, and improvement of aids to navigation in Ashtabula Harbor, Ohio. Under this appropriation the superstructure of the new pierhead at outer end of extended west breakwater has been constructed, the lighthouse structure moved to this pierhead from its old location, and an addition to this structure built. The light was placed in commission September 21, 1916, and the fog signal March 26, 1917. Amount expended to June 30, 1918, \$42,429.72.

Cleveland Harbor, Ohio.—The act of October 22, 1913, appropriated \$17,600 for removal, reconstruction, and improvement of the fog-signal station at Cleveland Harbor, Ohio. A fog-signal building has been constructed, the necessary plant installed, and the signal was placed in commission August 18, 1916. Amount expended to June 30, 1918, \$17,312.82.

Toledo Harbor, Ohio.—The act of July 1, 1916, appropriated \$15,000 for improving the aids to navigation in Toledo Harbor, Ohio. Two skeleton steel towers for Manhattan Range Lights have been erected and the lights were installed in the towers on May 25, 1918. Amount expended to June 30, 1918, \$13,231.81.

SPECIAL WORKS OF CONSTRUCTION UNCOMPLETED (OMITTING VESSELS).

FIRST DISTRICT.

Dog Island, Eastport, Me.—An appropriation of \$3,500 was made by the act of July 1, 1916, for placing an unattended light on Dog Island, Eastport, Me. Immediate steps were taken to procure title to the site, and after considerable delay the matter was placed in the hands of the proper United States district attorney for condemnation proceedings. The court has fixed \$500 as the amount to be paid for site. Payment will be made as soon as unpaid taxes and any liens against the property are adjusted. The date of completion is indefinite. No expenditures were made to June 30, 1918.

SECOND DISTRICT.

Woods Hole, Mass., Lighthouse Depot.—The act of July 1, 1916, appropriated \$50,000 for improvements at Woods Hole Depot, Mass. About 32,000 feet of channel 150 feet wide was dredged to a depth of 17 feet and a basin in front of depot 400 feet by 550 feet was dredged to 17 feet at a cost of \$30,162.97.

A two-story storehouse, 35 feet by 80 feet, of brick with steel frame and reinforced concrete floors and roof was finished by contract August 18, 1917. The electric lighting and equipment will be completed at an early date.

Amount expended to June 30, 1918, \$47,758.51.

THIRD DISTRICT.

Hunts Point, N. Y.—The act of March 4, 1911, appropriated \$5,000 for the establishment of a light and fog signal to mark Hunts Point, between Hell Gate and White-stone Point, East River, N. Y. The work of erecting a structure for the light and fog signal was started in November, 1916, and the light went into commission on January 4, 1917. The structure consists of a steel tower built on a stone and concrete foundation, with the necessary provision made for the establishment of a fog signal later when it is practicable to procure electric current for its operation. The date of the completion of this project is indefinite, but it is expected that it will be possible to get current and have fog signal in operation by June 15, 1919. Amount expended to June 30, 1918, \$3,520.21.

Aids to navigation, Hudson River, N. Y.—The act of July 1, 1916, appropriated \$100,000 for improving the aids to navigation and establishment of new aids on the Hudson River, N. Y. The work of improving, rebuilding, and establishing the aids will affect 24 different points. The work in progress consists in building and equipping barge for the purpose, which was delayed on account of the destruction by fire of the shipyard of the company which had the contract for its construction, taking necessary steps toward the acquisition of required sites and the purchase of the required lighting apparatus. The work was started in December, 1916, and it is expected will be completed about June 15, 1919. Amount expended to June 30, 1918, \$2,036.64.

Staten Island Lighthouse Depot, N. Y.—The act of June 12, 1917, appropriated \$21,000 for improving the offices and laboratory at the general lighthouse depot. Bids for doing the work were opened in May, 1918, but were rejected on account of the lowest bid received being more than the funds appropriated for the purpose. No work has as yet been done under this appropriation. Amount expended to June 30, 1918, \$10.04.

Aids to navigation, East River, N. Y.—The act of June 12, 1917, appropriated \$16,000 for improving the aids to navigation in the East River, N. Y., covers improvements and changes in the present system of lights and the establishment of an additional light. The lighting apparatus has been purchased. Layout of system has been taken up with maritime interests and approved, and steps are now being taken to procure the necessary grants for the parcels of land under water. The work was started in September, 1917, and it is expected will be completed about June 15, 1919. Amount expended to June 30, 1918, \$1,526.

Great Salt Pond Light Station, R. I.—The act of June 12, 1917 appropriated \$20,000 for building a new dwelling and moving the fog signal from the inner to the outer end of the breakwater. Plans for dwelling are completed, and steps are being taken to purchase necessary land. The work was started in November, 1917, and it is expected will be completed by June 15, 1919. No expenditures have as yet been made from this appropriation.

Staten Island Lighthouse Depot, N. Y.—The act of March 28, 1918, appropriated \$60,000 for repairing the wharves at the general lighthouse depot, Tompkinsville, N. Y. It is proposed to remove the old wooden decks, furnish and install additional steelwork, cast-iron pile columns, cleats, manhole frames, covers, and pipe hangers, and place new concrete decks on wharves. Plans for the south wharf, in connection with this work, have been prepared, bids opened, and contract now being made. It will be necessary, on account of incessant use of wharves, to do this work in three sections, one at a time. It is expected that the first section will be completed about October, 1918, and the second section in November, 1919. Amount expended to June 30, 1918, \$12.54.

FOURTH DISTRICT.

Joe Flogger Shoal, Del.—The act of June 20, 1906, authorized \$75,000 for establishing a light and fog signal at or near this shoal. The act of June 30, 1906, appropriated \$40,000 for this purpose, and the act of June 17, 1910, increased the limit of cost for this light and fog signal to \$105,000. No additional appropriation has yet been made. Work on this project has been deferred, as the total amount necessary has not been appropriated and other projects are considered of greater importance. The shoal is now marked by two gas buoys. Amount expended to June 30, 1918, \$603.21.

NOTE.—The sundry civil appropriation act approved July 1, 1918, provided that the unexpended balance of the appropriation of \$40,000 "toward a light and fog signal station on the Joe Flogger Shoal, Delaware River," contained in the act approved June 30, 1906, be made available for establishing gas buoys and improving aids to navigation in the vicinity of Joe Flogger Shoal, Del.

Delaware River, Pa., and Del., aids to navigation.—The act of March 3, 1915, authorized this work and the act of July 1, 1916, appropriated \$80,000 for the purpose. Under this appropriation the following work was completed or under way at the close of the fiscal year, on four structures marking two ranges of the new 35-foot channel:

Chester Range Front: Foundation crib placed at site and a 50-foot structural steel tower erected thereon.

Chester Range Rear: Concrete piers placed on timber grillage, and a 100-foot structural steel tower erected thereon.

Marcus Hook Range Front: Concrete block placed on a pile foundation, and a 72-foot structural steel tower erected thereon.

Marcus Hook Range Rear: Site purchased and contract awarded, foundations excavated, and some work done in placing the concrete foundations for tower, dwelling, and outbuilding. A 100-foot mast was erected to support a temporary light.

Under this appropriation the bell at Fort Mifflin fog signal was replaced by an electric siren.

It is expected that all work under the appropriation will be completed during 1919. Amount expended to June 30, 1918, \$47,761.49.

FIFTH DISTRICT.

Aids to navigation, Cape Charles City, Va.—The act of June 12, 1917, appropriated \$12,800 for improving lights and fog signals leading to Cape Charles City, Va. Plans and specifications have been prepared for Cherrystone Bar Light, to cover a small caisson-type structure which will show an unwatched acetylene and support an automatic fog bell actuated by compressed carbon-dioxide gas. It is anticipated that this structure will be completed by October, 1918. No money has been expended from this appropriation to June 30, 1918.

Aids to navigation, Chesapeake Bay, Md. and Va.—The act of June 12, 1917, appropriated \$29,000 for aids to navigation on the eastern shore of the Chesapeake Bay and tributaries. Requisition has been made on the general depot for one service type S buoy for use in the Susquehanna River. Amount expended to June 30, 1918, \$1,201.80.

Repairing and rebuilding aids to navigation, Atlantic coast.—The act of March 28, 1918, appropriated \$150,000 for rebuilding, repairing, and reestablishing aids damaged by storm and ice, from which \$100,000 was allotted to the fifth district. Thirty-eight minor lights carried away by ice have been rebuilt. Equipment for 8 gaslight installations for minor lights has been purchased. Material for rebuilding all the minor lights has been purchased. Plans and specifications for riprap around 6 screw pile lighthouses damaged by ice have been prepared and bids opened June 15, 1918. Plans and specifications for strengthening the foundation of Tangier Sound Light Station have been prepared. Amount expended to June 30, 1918, \$13,137.77.

SIXTH DISTRICT.

St. Johns River, Fla.—The act of July 1, 1916, appropriated \$66,000 for improving aids to navigation and establishing new aids on the St. Johns River, Fla. One lens lantern light on an 8-foot pipe tower on creosoted piles and one post lantern light on a wooden tower on creosoted piles have been established, and 5 light structures have been rebuilt, using pipe towers on creosoted piles, replacing less permanent construction. Numerous minor improvements have been made to light structures, and several other light structures are nearly completed. A 60-foot pipe tower, 11 smaller pipe towers, and all illuminating apparatus necessary to complete this project are on hand. Two gas buoys are on hand ready to be established at an early date, and 4 unlighted buoys have been changed to larger class and additional buoys have been ordered.

Three unlighted beacons consisting of 5-pile structures have been established in Wilson Channel. Amount expended to June 30, 1918, \$23,237.94.

SEVENTH DISTRICT.

Florida Reefs, Fla.—The act of July 1, 1916, appropriated \$75,000 for establishing additional aids, and repairing and improving existing aids. Under this appropriation part of the illuminating apparatus was ordered and has been delivered. Three attempts have been made to obtain proposals for metal work and glass for the two towers to go on Molasses and Pacific Reefs, but with no success. The date of completion is indefinite. Amount expended to June 30, 1918, \$3,427.56.

EIGHTH DISTRICT.

Aids to navigation, Mississippi River, La.—The act of July 1, 1916, appropriated \$50,000 for the improvement of aids to navigation on the Mississippi River below New Orleans. Contract was entered into June 22, 1917, for furnishing 25 structural-steel towers. The contractor had trouble in securing material and at the end of the year a number of the towers were being inspected by a representative of this Service. Amount expended to June 30, 1918, \$567.57.

Aids to navigation, Atchafalaya Entrance Channel, La.—The act of October 22, 1913, appropriated \$50,000 for establishing aids to navigation in Atchafalaya Entrance Channel, La. During the fiscal year ended June 30, 1916, Point au Fer Reef Lighthouse and Atchafalaya Entrance Channel Lights Nos. 1, 3, 5, 7, 9, and 2 were completed. A 42-foot motor launch was completed by the United States Naval Station, New Orleans, La., during the fiscal year at a cost of \$6,951.71. Requisition for the necessary gas-lighted buoys has been partly filled at end of year. Amount expended to June 30, 1918, \$36,383.59.

Aransas Pass Light Station, Tex.—The act of October 6, 1917, appropriated \$20,000 for repairing and rebuilding dwellings, outbuildings, and appurtenant structures damaged or destroyed in the hurricane of August 18, 1916. During the fiscal year a contract was awarded for building a dwelling, oil house, T wharf, walks, etc. The contractor commenced work at the station during May, 1918, and at the end of the fiscal year had progressed with driving piles for the foundation of dwelling, outhouses, oil house, walks, and wharf. Amount expended to June 30, 1918, \$5.75.

Galveston Jetty Light Station, Tex.—The act of June 11, 1896, appropriated \$35,000, and the act of May 27, 1908, \$10,000 for establishing a light and fog signal station at or near the outer end of one of the jetties at Galveston Harbor, Tex. Great damage was done the uncompleted structure by the hurricane of August 16-17, 1915, which destroyed the construction wharf, bent the framework of the structure, and washed away much material. Subsequently materials were again assembled, another wharf erected, and the framework straightened. The construction wharf was again washed away in the hurricane of August 18, 1916, and some of the lower struts of the substructure were again bent. A portion of the lens for this station was lost in the hurricane of July 5-6, 1916, one box containing parts of same having been washed away from the Mobile Lighthouse Depot. It was replaced from the third district. In March, 1917, the construction wharf was rebuilt for the third time. At the end of May, 1917, the installation of intermediate beams to reinforce struts was completed. A concrete block 40 feet square around foundation piles and in places 10 to 15 feet in depth on northerly and southerly edges was completed during the fiscal year and the illuminating apparatus was installed. A requisition has been made for fog-bell striking machinery for the fog signal, and contract for furnishing and placing riprap around station has been entered into to be paid out of appropriation, general expenses, Lighthouse Service, 1918. The repair work stated above—viz, intermediate beams to reinforce struts of lower and middle sections, the construction wharf necessary to install the intermediate beams, and the building of the concrete block—were paid for from the appropriation, general expenses, Lighthouse Service, 1917, as this work was necessary before light could be established. The light has not been exhibited, due to the extinguishment of lights at the entrance to Galveston Harbor by orders of the Navy Department. Amount expended to June 30, 1918, \$44,649.86.

Repairing and rebuilding aids to navigation, Gulf of Mexico.—The act of February 28, 1916, appropriated \$200,000 for repairing and rebuilding aids to navigation damaged or destroyed by hurricanes on the Gulf of Mexico. In addition to the work which had been completed, as stated in the annual report for the fiscal year ended June 30, 1917, there is given below a list of the work that has been completed during present fiscal year and that in progress. During the fiscal year the following portions of the work have been completed:

Bolivar Point Light Station, Tex.: Construction of two frame dwellings supported on high iron columns which rest on pile foundations, oil house, outhouses, and fences.

Chefuncte River Light Station, La.: New cypress sheet-pile breakwater on east and west sides of station; repair of boathouse and wharf; fence rebuilt.

Lake Borgne Light Station, Miss.: Boathouse and wharf on creosoted piles; walks and platforms, rebuilt; dwelling repaired.

Pointe aux Herbes Light Station, La.: New cypress sheet-pile breakwater, about 750 feet long, new walks, and outhouse replaced on new foundation.

Round Island Light Station, Miss.: New wharf on creosoted piles with creosoted stringers, headers, and braces; boathouse in the water and fences repaired.

The following work is in progress at the end of the fiscal year:

Bayou St. John Light Station, La.: Repairing wharves to lights, platform around main light, fence and walks at dwelling, etc.

Calcasieu Light Station, La.: Material has been ordered to rebuild 1,420 feet of walk, 50-foot wharf to range light, etc.

Cape San Blas Light Station, Fla.: A part of the material required to move this tower to a new site further inshore was purchased from this appropriation. This work is now in progress.

Cat Island Light Station, Miss.: New wharf on creosoted piles with creosoted stringers, headers, and braces; new boathouse on square, sawn, creosoted piles with cast-iron pipe sleeves; new platform under station, etc.

Galveston Depot, Tex.: Creosoted piles, caps, and joists have been ordered for depot wharf.

Pass Manchac Light Station, La.: Rebuilding 125 feet of cypress sheet-pile break-water, storehouse, and boathouse on creosoted piles, fence, etc.

Sabine Bank Light Station, Tex.—Iron shell plates, davits, foot plates, railing, etc., were received during fiscal year and are being installed. The veranda floor of light-house will be closed in with cast-iron plates and davits raised. Amount expended to June 30, 1918, \$159,690.77.

The act of September 8, 1916, appropriated \$125,000 for repairing and rebuilding aids to navigation damaged or destroyed by hurricanes on the Gulf of Mexico, of which \$122,200 was allotted for this district. In addition to the work which had been completed, as stated in the annual report for the fiscal year ended June 30, 1917, there is given below a list of the work that has been completed during present fiscal year and that in progress. During the fiscal year the following portions of the work have been completed:

Grand Batture Island Shoal Beacon 8, Miss.: Single iron-cased pile structure rebuilt.

Great Point Clear Light, Ala.: Pyramidal structure on 9 iron-cased creosoted piles, showing oil lens lantern light, rebuilt.

Gulfport Channel Light No. 1, Miss.: House surmounted by pyramid on 9 iron-cased creosoted piles, showing oil lens lantern light, rebuilt.

Horn Island Light Station, Miss.: New steps and minor repairs.

Horn Island Cut Beacon, Miss.: Slatted pile structure on mud sill, rebuilt.

Mobile Channel Lights Nos. 2, 4, 6, 8, 12, 14, 18, 20, 22, 24, 28, 32, 36, and Cut-off Channel Beacon 4, Ala.: Thirteen structures, each on 9 iron-cased creosoted piles, supporting house surmounted by pyramid, from which acetylene lens lantern light is shown, and 1 single iron-cased creosoted-pile day beacon, rebuilt.

Mobile Channel Lights Nos. 10, 16, 26, 30, 34, 38, 40, and 42, Ala.: Eight structures repaired or partially rebuilt, showing acetylene lens lantern lights.

Mobile Point Beacon Light, Ala.: Pyramidal structure on mud sills supported by 4 creosoted piles, showing oil lens lantern light, rebuilt.

Pascagoula River Lights A and B, and Beacons 2 and 6, Miss.: Two pyramidal structures, each on nine iron-cased creosoted piles, showing oil lens lantern light, and two single iron-cased creosoted-pile beacons, rebuilt.

Pensacola Bay Range Front Light, Fla.: Nine iron-cased creosoted-pile structure, supporting house with pyramidal lantern support, showing oil-lens lantern, rebuilt.

Round Island Light Station, Miss.: Fences, walks, boathouse on shore and dwelling repaired.

Round Island South Spit Light, Miss.: Pyramidal structure on nine iron-cased creosoted piles, showing oil lens lantern light, rebuilt.

Sand Island Light Station, Ala.: Two thousand and seven hundred tons of rock, ranging in weight from 1 to 4 tons each piece, were placed around the tower. New boathouse on eight creosoted piles built.

Ship Island South Channel Range Rear Light, Miss.: Pyramidal structure on four creosoted piles, showing oil lens lantern light, rebuilt.

South Pass West Jetty Range Rear Light, La.: Pyramidal structure on four iron-cased creosoted piles, showing acetylene reflector light, rebuilt. Walk from river to light repaired.

The following work is in progress at the end of the fiscal year:

Cape San Blas Light Station, Fla.: Move tower to a point further inshore because of the encroachment of the sea. A wharf and walk about 1,925 feet long was built from old site of tower to proposed new site, the tower taken down, and 21 of the 36 creosoted piles for new foundation of tower were driven. Amount expended to June 30, 1918, \$97,266.43.

The act of March 28, 1918, appropriated \$100,000 for rebuilding, repairing, and reestablishing aids to navigation and structures connected therewith on the coast of the Gulf of Mexico damaged or destroyed by hurricanes.

Fifty thousand feet board measure creosoted, square, sawn pine piles have been ordered to rebuild aids to navigation; materials have been assembled to commence rebuilding Deer Point and Fair Point Lights, Fla. Amount expended to June 30, 1918, \$5.31.

Sabine Pass Light Station, La.—The act of May 27, 1908, appropriated \$40,000 for a light and fog signal at or near the end of Sabine Pass Jetty. Nothing has been done on the work, in view of the proposed project of the War Department to extend the jetties to the 25-foot contour, a distance of possibly 2 miles. At the close of the fiscal year 1918 no money had been expended or obligated.

NINTH DISTRICT.

Point Borinquen Light Station, P. R.—The act of June 12, 1917, appropriated \$85,000 for the construction of Point Borinquen Light Station. Plans and specifications have been prepared, and steps have been taken to purchase the site. No work has been done or expenditures made under this appropriation to June 30, 1918.

TENTH DISTRICT.

Lorain Harbor, Ohio.—The act of October 22, 1913, appropriated \$35,000 for a light and fog-signal station and improvement of aids to navigation at Lorain Harbor, Ohio. The concrete structure has been erected and temporary light placed in operation in the new lantern. The interior of building, outside steps, railing, etc., remain to be completed. Amount expended to June 30, 1918, \$32,443.71.

Conneaut Harbor, Ohio.—The act of July 1, 1916, appropriated \$63,500 for a light and fog-signal station and improving aids to navigation at Conneaut Harbor, Ohio. Detail plans for the structure have been approved. Concrete foundation completed. Contracts have been awarded for the metal work, brick, and stone. Owing to existing conditions regarding deliveries, etc., active work of erecting the superstructure will probably have to be deferred until next season. Amount expended to June 30, 1918, \$21,681.40.

Huron Harbor, Ohio.—The act of June 12, 1917, appropriated \$4,500 for establishing aids to navigation at Huron Harbor, Ohio. Contract has been made for the steel tower for rear range light. Amount expended to June 30, 1918, \$11.84.

Fairport Harbor, Ohio.—The act of June 12, 1917, appropriated \$42,000 for improving aids to navigation at Fairport Harbor, Ohio. Amount expended to June 30, 1918, \$400.

ELEVENTH DISTRICT.

Detroit River, Mich.—The act of March 4, 1911, appropriated \$210,000 for establishing aids to navigation along the Livingstone Channel, Detroit River, Mich., including authority to locate and construct lights and to place buoys necessary to properly mark this channel. To June 30, 1918, 12 concrete piers have been completed and 9 beacon lights placed in commission. The other 3 await completion of contemplated changes in the channel before they can be utilized. Thirteen gas buoys and 21 spar buoys are now used to mark the channel in addition to the lights on piers. Plans have been prepared for the construction of a light and fog signal near the southern end of the channel which, if carried out, will relieve a lightship now maintained in the locality and which is becoming badly deteriorated, requiring early condemnation. Two additional pier lights will be established, taking the place of gas buoys now maintained on the west side. This can not be done until the proposed channel widening has been completed. In addition to the lights along the channel proper a semaphore system for controlling the movements of vessels through the channel has been constructed and placed in operation. One of the semaphores, giving the first warning to vessels, has been moved to a point farther away from the entrance of the channel in order that vessels checked by it may have more room for anchorage and maneuver in case of necessity. The semaphore lights for this station have been changed from oil to acetylene, with a resultant increase in power. Total expenditure to June 30, 1918, \$168,713.02.

Aids to navigation, Fighting Island Channel, Detroit River, Mich.—The act of July 1, 1916, appropriated \$25,000 for aids to navigation, Fighting Island Channel, Detroit River, Mich. Under this appropriation a nonattended acetylene flashing light has been established at the southern entrance on the east side of the channel, and a similar light at the northern entrance on the east side, these lights being known as Fighting Island South and North Lights, respectively. Intermediate, between the above permanent lights on the east side, are installed three type S acetylene-gas buoys at approximately equal intervals. On the west side and approximately opposite the three gas buoys two permanent lights are maintained, with one type S acetylene-gas

buoy intermediate. Fighting Island South Light was placed in commission in November, 1916, and the North Light in December, 1917. Gas-buoy stations were marked temporarily by Pintsch gas buoys pending the installation of acetylene buoys, which were placed on station at the opening of navigation 1918. Four ranges along the channel, formerly maintained, are now eliminated, single lights being maintained in each case, as the channel is now straight for the entire distance. It is expected that two of the lights from these old ranges will be altered to nonattended acetylene during the coming year. The Fighting Island North Light, which was constructed in 13 feet of water and completed during the last year, serves an important purpose in providing a light at the entrance to the channel in the spring before buoys can be placed and in the fall after their removal is necessary. It further serves as a location for one of the Livingstone Channel semaphore stations. Amount expended to June 30, 1918, \$13,110.36.

Sand Hills Light Station, Mich.—The act of June 12, 1917, appropriated \$70,000 for the establishment of a light station and fog signal at or near Sand Hills, Mich. During the past season the site has been surveyed and purchased. Materials for the station are practically all delivered and necessary clearing operations practically completed, the foundation of the dwellings and tower completed, and other construction well started. Work is now proceeding rapidly, and it is anticipated that the fog signal and probably also the main light at this station will be placed in commission during the current season. During the period of construction and until the light and fog signal are in operation a temporary lens-lantern light is being maintained, and an electrically operated siren is being used as a fog signal. The buoy formerly maintained on the shoal has been discontinued, owing to the establishment of the temporary light. Amount expended to June 30, 1918, \$29,941.08.

Aids to navigation, Keweenaw Waterway, Mich.—The act of June 13, 1917, appropriated \$100,000 for aids to navigation, Keweenaw Waterway, Mich. During the past season a necessary preliminary examination of the site for the main light and fog-signal structure was carried out. Steps were taken to secure rights of way for electric power lines. The consent of the War Department was obtained for occupancy of land and structures and construction work on the main light and fog-signal structure actively started. The plans which have been approved and are now being carried out contemplate electrification of all beacons in the Portage River as far north as Portage Lake, service to all being given by an electric line connecting with a generating station located at Portage Entry. An air-compressing plant established at the same location will furnish power for operating a first-class siren at the new light and fog-signal station on the pierhead. The main light will also be electric, supplied with power from the main generating station. Quarters will be provided for three keepers and the necessary minor structures in connection with the station provided. All beacons in that portion of the river under improvement will be reconstructed in permanent form except where they are subject to possible changes in location due to proposed channel improvements. A derrick scow for use in connection with the construction of this station has been completed during the year and is now being employed on the work. Amount expended to June 30, 1918, \$15,579.69.

TWELFTH DISTRICT.

White Shoal, Mich.—The act of March 4, 1907, appropriated \$250,000 for a light and fog-signal station at White Shoal, Mich., in the north end of Lake Michigan, to replace the White Shoal Light Vessel. Tower was completed and light placed in commission September 1, 1910; fog signal placed in commission September 15, 1910; submarine bell established September 20, 1911; water-supply system installed October, 1911; oil-storage system installed June, 1913; auxiliary flashing winter light established December, 1914. Equipment of three boat cranes with air-driven hoists under way; \$1,900 allotted from special appropriation for this purpose. Amount expended to June 30, 1918, \$226,494.03.

Chicago Harbor, Ill.—The act of June 12, 1917, appropriated \$88,000 for the removal of the Chicago Harbor Light and Fog Signal from its present location to the south end of the north arm of the extension of the exterior breakwater and rebuilding the station. Skeleton steel towers are to be erected on both the north and south ends of the south-arm extension and are to be equipped with acetylene lights. Light and fog signal have been discontinued at old site; fog signal established at new site; concrete base completed; tower removed from old site and partially erected on new concrete base; steel fog signal and boat houses being fabricated at shop; temporary acetylene construction light established at new site; steel towers and acetylene equipment for south-arm extension purchased; north-end light, south-arm extension, to be established and main light to be reestablished this season. Amount expended to June 30, 1918, \$55,093.18.

Indiana Harbor, Ind.—The act of June 12, 1917, appropriated \$100,000 for the establishment and improvement of aids to navigation at Indiana Harbor, Ind. Light-house tower and fog signal to be erected at east end of north arm of the breakwater. A skeleton steel tower is to be erected on the north end of the south arm on a concrete base and acetylene light installed. Amount expended to June 30, 1918, \$28.

Manitowoc Breakwater, Wis.—The act of June 12, 1917, appropriated \$21,000 for improving the light and fog-signal station at Manitowoc, Wis.; new steel fog-signal and light station to be erected; improved light to be established, and first-class air siren and compressors to be installed; old structure removed from end of breakwater; concrete sub-base for the tower is being built by United States engineers; contract let for steel work for tower and fog-signal house; concrete foundation to be built by United States engineers. Amount expended to June 30, 1918, \$964.23

SIXTEENTH DISTRICT.

Aids to navigation, Alaska.—The acts of August 1, 1914, and June 12, 1917, each appropriated \$60,000 for establishing and improving aids to navigation in Alaskan waters. During the fiscal year 1918 one gas buoy, 1 oil post lantern, and 6 acetylene lights were established from the above appropriations. Illuminating apparatus and other material were purchased for 8 additional acetylene lights and 3 gas buoys, and of these several were nearing completion at the close of fiscal year 1918. On June 30, 1918, the balance from the appropriation of August 1, 1914, had been expended. Amount expended to June 30, 1918, \$96,847.38.

SEVENTEENTH DISTRICT.

Aids to navigation, Puget Sound, Wash.—The act of October 22, 1913, appropriated \$30,000 for aids to navigation and improvements in existing aids in Puget Sound and adjacent waters, Washington. Under this appropriation the following work has been performed:

Marrowstone Point Light Station, Wash.: A new light and fog-signal building was built at a cost of \$1,112.13. Change in light from acetylene to electric was made at a cost of \$311.54. Change in fog signal from acetylene gun to third-class Daboll trumpet, operated by an electrically driven rotary compressor unit, was made at a cost of \$2,771.61.

Apple Cove Point, Wash.: An acetylene flashing light was established on this point at a cost of \$1,106.

Amount expended to June 30, 1918, \$29,216.17.

Kellett Bluff Light Station, Wash.—The sundry civil act approved July 1, 1916, appropriated \$40,000 for establishing a light and fog-signal station at or near Kellett Bluff, Henry Island, Wash., or at some point on the west coast of San Juan Island, Wash. After due consideration, the point known as Lime Kiln, on the west coast of San Juan Island, was decided upon as a location for this aid, to be known as Lime Kiln Light Station and to consist of a fourth-order flashing light and third-class fog signal. Proposals were invited for the construction of the buildings, but the bids, being considered excessive, were rejected and it was decided to perform the work by hired labor. The work will be started in the early part of the next fiscal year. Amount expended to June 30, 1918, \$3,095.54.

Aids to navigation, Coquille River, Oreg.—No active operations have been carried out on this project during the year, for which \$6,000 was appropriated by sundry civil act of July 1, 1916, first on account of uncertainty as to the stability of the site (enrockment of South Jetty), and second on account of recent opposition to the transfer of the light from its present location, a matter which is now under investigation. Amount expended to June 30, 1918, \$36.34.

Aids to navigation, Washington and Oregon.—The sundry civil act approved June 12, 1917, appropriated \$35,000 for new aids and improvements to existing aids. Materials for the installation of four occulting acetylene light installations have been purchased and are being assembled. Amount expended to June 30, 1918, \$192.11.

EIGHTEENTH DISTRICT.

Point Vincente, Cal.—The act of July 1, 1916, appropriated \$80,000 for establishing a light and fog signal at Point Vincente, Cal. The site was under controversy, and the United States attorney prepared the data preliminary to entering suit for condemnation of suitable site; action has been deferred and the condemnation suit has been postponed. Sketch drawings have been approved, detail drawings of a reinforced concrete tower have been approved, and detail drawings of keepers' quarters have been prepared. The Bureau standard cylindrical helical bar lantern, 9 feet 9 inches inside diameter, will be used. The lens is being assembled at the general depot. The date of completion will depend upon the acquisition of site. Amount expended to June 30, 1918, \$13.50.

NINETEENTH DISTRICT.

Aids to navigation, Pearl Harbor, Hawaii.—The act of March 3, 1915, authorized \$80,000 for establishing aids in Pearl Harbor, which amount was appropriated by act of June 12, 1917. Location of aids determined and borings made. Privilege to occupy sites and lay necessary cable secured. System of lights satisfactory to the Navy Department has been approved. Preliminary plans of the proposed structures now under consideration by the Bureau. Two gas buoys for this project purchased and part of apparatus for same has been received. Amount expended to June 30, 1918, \$1,192.91.

UNEXPENDED BALANCES ON JUNE 30, 1918, FROM APPROPRIATIONS FOR SPECIAL WORKS.

District.	Title of appropriation.	Acts.	Balance.
General....	Repairing and rebuilding aids to navigation, Atlantic Coast.	Mar. 28, 1918.....	\$138,742.24
	Tender for first lighthouse district.....	May 27, 1908.....	4,298.15
	Light vessels for general service.....	Aug. 24, 1912; Aug. 26, 1912.....	148,894.31
	Lighthouse tender, general service.....	June 25, 1915.....	1,718.24
	Light vessels for general lake service.....	June 12, 1917.....	149,887.78
	Radio installations on lighthouse tenders.....	do.....	59,976.88
	Oil houses for light stations.....	June 25, 1910.....	388.55
2d.....	Cape Cod Canal Lights, Mass.....	Aug. 1, 1914.....	1,951.49
	Woods Hole Lighthouse Depot, Mass.....	July 1, 1916.....	2,241.49
	Nantucket Harbor Fog Signal, Mass.....	Mar. 28, 1918.....	15,000.00
3d.....	Newark Bay Beacon Lights, N. J.....	Mar. 4, 1907; Oct. 22, 1913.....	82.19
	Staten Island Lighthouse Depot, N. Y. (carpenter's shop).	Mar. 3, 1901; June 28, 1902.....	827.90
	Hunts Point Light Station, N. Y.....	Mar. 4, 1911.....	1,479.79
	Aids to navigation, Hudson River, N. Y.....	July 1, 1916.....	99,753.01
	Tender for third lighthouse district.....	June 12, 1917.....	149,927.63
	Aids to navigation, East River, N. Y.....	do.....	15,999.00
	Great Salt Pond Light Station, R. I.....	do.....	20,000.00
	Staten Island Lighthouse Depot, N. Y. (wharves)	Mar. 28, 1918.....	600.00
4th.....	Aids to navigation, Delaware River, Pa. and Del.	July 1, 1916.....	32,338.51
5th.....	Thimble Shoal Light Station, Va.....	June 25, 1910.....	2,084.55
	Lighting Norfolk Harbor, Va.....	Mar. 4, 1911.....	2,121.20
	Cape Charles Light Vessel, Va.....	June 12, 1917.....	130,000.00
	Aids to navigation, Cape Charles City, Va.....	do.....	12,800.00
	Aids to navigation, Chesapeake Bay, Md. and Va.	do.....	29,000.00
6th.....	Tender engineer, sixth lighthouse district.....	Apr. 28, 1904.....	396.46
	Aids to navigation, St. Johns River, Fla.....	July 1, 1916.....	42,762.06
7th.....	Aids to navigation, Florida Reef, Fla.....	do.....	4,072.44
8th.....	Galveston Jetty Light Station, Tex.....	June 11, 1906.....	350.14
	Sabine Pass Jetty Light Station, Tex.....	May 27, 1908.....	40,000.00
	Southwest Pass Light Vessel, Mississippi River.	Oct. 22, 1913.....	14,404.75
	Aids to navigation, Atchafalaya Entrance Channel, La.	do.....	15,666.41
	Repairing and rebuilding aids to navigation, Gulf of Mexico.	Feb. 28, 1916; Sept. 8, 1916; Mar. 28, 1918.....	165,492.73
	Aids to navigation, Mississippi River, La.....	July 1, 1916.....	49,432.43
	Tender and barge, for eighth lighthouse district	do.....	19,986.86
	Aransas Pass Light Station, Tex.....	Oct. 6, 1917.....	19,994.25
9th.....	Navassa Island Light Station, West Indies.....	Oct. 22, 1913.....	3,948.32
	Point Borinquen Light Station, P. R.....	June 12, 1917.....	85,000.00
10th.....	Cleveland Fog-signal Station, Ohio.....	May 27, 1908.....	280.03
	Aids to navigation, Ashtabula Harbor, Ohio.....	Oct. 22, 1913.....	2,605.17
	Aids to navigation, Lorain Harbor, Ohio.....	do.....	2,556.29
	Aids to navigation, Conneaut Harbor, Ohio.....	July 1, 1916.....	41,818.60
	Aids to navigation, Toledo Harbor, Ohio.....	do.....	1,768.19
	Aids to navigation, Huron Harbor, Ohio.....	June 12, 1917.....	4,488.16
	Aids to navigation, Fairport Harbor, Ohio.....	do.....	41,600.00
11th.....	Superior Pierhead Range Lights, Wis.....	June 30, 1906.....	1,917.10
	Detroit River Lights, Mich.....	Mar. 4, 1911.....	41,286.98
	Aids to navigation, Fighting Island Channel, Detroit River, Mich.	July 1, 1916.....	11,889.64
	Sand Hills Light Station, Mich.....	June 12, 1917.....	40,058.92
	Aids to navigation, Keweenaw Waterway, Mich.	do.....	89,420.31
12th.....	White Shoal Light Station, Lake Michigan.....	Mar. 4, 1907.....	23,505.97
	Chicago Harbor Light Station, Ill.....	June 12, 1917.....	32,906.82
	Manitowoc Breakwater Light Station, Wis.....	do.....	20,035.77
	Aids to navigation, Indiana Harbor, Ind.....	do.....	99,972.00
16th.....	Aids to navigation, Alaska.....	June 12, 1917.....	23,152.62
	Cape St. Elias Light Station, Alaska.....	Oct. 22, 1913.....	297.61
17th.....	Aids to navigation, Puget Sound, Wash.....	do.....	783.83
	Kellett Bluff Light Station, Wash.....	July 1, 1916.....	30,904.46
	Aids to navigation, Coquille River, Oreg.....	do.....	5,963.66
	Aids to navigation, Washington and Oregon.....	June 12, 1917.....	34,807.89
18th.....	Point Vicente Light Station, Cal.....	July 1, 1916.....	79,986.59
19th.....	Aids to navigation, Pearl Harbor, Hawaii.....	June 12, 1917.....	78,807.09

**SAVING OF LIFE AND PROPERTY BY VESSELS OR EMPLOYEES OF THE
LIGHTHOUSE SERVICE DURING THE FISCAL YEAR 1918.**

District.	Vessel or employee rendering service.	Vessel, etc., aided.	Nature of assistance.
1st.....	E. L. Farren, keeper, Eagle Island Light Station, Me.	Sloop.....	Rendered assistance to sick captain of sloop.
	Tender Hibiscus.....	Mail boat.....	Rescued 3 men endeavoring to carry mail across West Penobscot Bay, Me., on the ice, with aid of small boat, and repaired boat. But for timely arrival of Hibiscus, men, mail, and boat would probably have been lost.
	Tender Zizania.....		Proceeded, through heavy ice, to Mark Island, West Penobscot Bay, Me., distance of 15 miles; procured physician for man with broken leg, and landed him at Islesboro, Me., after medical assistance was rendered.
	Tender Hibiscus.....	Small boat.....	Rescued woman and son from distressed boat.
	Do.....	Power boat Oyama.....	Towed disabled boat with 2 men aboard to New Harbor, Me.
	P. L. Marr, keeper, The Cuckolds Light Station, Me.	Schooner Annie and Reuben.	Signaled life-saving crew and assisted in piloting them and running hne to distressed schooner, ashore in fog near station.
	E. V. Talbot, assistant keeper, The Cuckolds Light Station, Me.	Motor boat Qult....	Assisted in getting ashore a party of 7 men and women in motor boat lost in fog and filling with water; sounded distress signal and furnished party dry clothing and refreshments.
	J. E. Purington, keeper, Nash Island Light Station, Me.	Power boat.....	Furnished lodging to party of 5 from disabled boat.
	L. B. Dudley, keeper, Saddleback Ledge Light Station, Me.	Power boat; Benj. Hollett, owner.	Furnished lodging and gasoline to occupant.
	H. G. Sawyer, keeper, Bear Island Light Station, Me.	Motor boat.....	Towed disabled boat with occupant to Northeast Harbor, Me.
	J. W. Jellison, keeper, Tenants Harbor Light Station, Me.	.....do.....	Towed disabled boat to safe anchorage through strong wind and rough sea.
	Tender Zizania.....		The tender Zizania proceeded to Vinalhaven, Me., with mail, passengers, and provisions, that town having been shut off from all sources of supplies for upward of 11 days on account of severe weather and ice conditions. She later returned to Vinalhaven and took aboard passengers, mail, and freight, and proceeded to Rockland; towed disabled boat, with 4,000 live lobsters on board, to Rockland; assisted schooner jammed in the ice.
2d.....	Tender Azalea.....	Tug W. S. Taylor, Potter Transportation Co.	Towed disabled tug to Boston Bay, Mass., where another tug took her for docking.
	J. E. H. Cook, keeper, Cape Ann Light Station, Mass.	Motor boat from schooner Commonwealth.	Furnished food and transportation to mainland to 2 fishermen adrift 4 days.
	E. C. Mott, keeper, Deer Island Light Station, Mass.	Motor boat; John J. Grant, owner.	Towed disabled motor boat with party of 5 to safe anchorage.
	F. E. Davis, keeper, Duxbury Pier Light Station, Mass.	Motor boat.....	Towed disabled boat with party of 3 to Plymouth, Mass.
	Tender Anemone.....	U. S. S. Lakewood and 2 tugs.	Attempted to pull steamer Lakewood off shoal, and towed 2 tugs to her to lighten her cargo of coal.
	Tender Azalea.....	Tug Mexpet; Mexican Petroleum Co., owners.	Towed disabled tug and barge to Vineyard Haven, Mass., and put to anchor.
	Do.....	Steamer Ruby.....	Went to assistance of stranded steamer.
	Tender Anemone.....	U. S. S. mine sweeper Whitecap.	Assisted in floating mine sweeper stranded on rocks.
	Tender Azalea.....	Barge Arenac; W. McCormack, owner.	Towed disabled barge in sinking condition to Vineyard Haven, Mass.

SAVING OF LIFE AND PROPERTY BY VESSELS OR EMPLOYEES OF THE LIGHTHOUSE SERVICE DURING THE FISCAL YEAR 1918—Continued.

District.	Vessel or employee rendering service.	Vessel, etc., aided.	Nature of assistance.
2d.....	C. H. Jennings, keeper, Boston Light Station, Mass.	U. S. S. Alacrity....	Assisted in endeavor to float stranded steamer under dangerous ice and weather conditions; carried dory across island over icy and slippery rocks; transferred crew and dunnage aboard when ship was about to be floated; furnished crew with food.
3d.....	Tender Daisy.....	Power yacht Eveleen III; Harry B. Newman, owner.	Towed disabled yacht with party on board to landing of Lake Champlain Yacht Club.
	J. McDougall, keeper, Coxsackie Light Station, N. Y.	Power launch Lafalot; D. J. Mahoney, New York, owner.	Extinguished fire on launch.
	E. J. Rathbun, keeper, Point Judith Light Station, R. I.	Power boat.....	Assisted in recovering 2 men during rough weather and high sea from capsized boat, and endeavored to revive men.
	C. R. Riley, keeper, Bridgeport Breakwater Light, Conn.	Power boat; Oren Barber, owner.	Rescued man and wife from disabled and sinking boat, ashore on breakwater, and furnished them food and shelter.
	J. Marshall, fireman, Orlandi Orlando, seaman, tender Daisy.	.....	Rescued from drowning in strong flood tide 2 men thrown into water from capsized boat.
	V. Knies, assistant keeper, Whale Rock Light Station, R. I.	Motor dory Nadine; Jos. Sambrook, owner.	Repaired disabled engine of boat and towed boat to Newport.
	R. C. Ridgway, assistant keeper, Rockland Lake Light Station, N. Y.	Motor boat.....	Rescued man, wife, and 2 children from motor boat, ashore on rocks and in sinking condition; pulled boat off rocks and brought party to station.
	E. Jansen, keeper, Lime Rock Light Station, R. I.	Boat.....	Rescued 2 men during storm from boat and took them and their provisions to their barges.
	Relief Light Vessel No. 78 on Fire Island Light Vessel No. 68 station, N. Y.	Schooner Edith M. Prior.	Furnished schooner, in leaking condition, water, provisions, and coal.
	Tender Myrtle.....	Transport Laplund.	Assisted in recovering lifeboat unhooked and capsized.
	K. Niblett, keeper, Great Beds Light Station, N. J.	.....	Towed oyster skiff, adrift, to station; thence to Perth Amboy, N. J.
	W. J. Murray, keeper, Sylvester Kendzia, first assistant keeper, Paul G. Petersen, second assistant keeper, Little Gull Island Light Station, N. J.	.....	Assisted in transferring mail, etc., from shore to outer end of wharf at Fort Michie, N. Y., damaged by storm.
	G. J. Thomas, keeper, Fire Island Light Station, N. Y.	.....	Rescued 2 aviators from sinking hydroplane, in Great South Bay, and transported them to aviation camp at Bay Shore.
	R. G. Hendricks, laborer in charge, Fitchs Point, White Rock Reef, and Long Beach Lights, Conn.	.....	Rescued boy marooned on Cockenoe Island for 36 hours on account of storm, and took him home.
	Tender Larkspur.....	S. S. City of Montgomery.	Rescued frozen and nearly unconscious sailor who had fallen overboard, furnished medical attention, dry clothes, and took him to hospital.
	Tender Myrtle.....	Gasoline power boat Mary Ella.	Towed boat, ice bound in Narrows, New York Bay, to landing at Stapleton, Staten Island.
	.....do.....	Launch from H. M. S. Carnaral.	Towed launch through ice to berth alongside H. M. S. Carnaral.
	Tender Tulp.....	Tail of the Horse Shoe Light Vessel No. 46, Va.	Went to assistance of light vessel under rigorous and hazardous weather conditions.
	Tender Mistletoe.....	Bartlett Reef Light Vessel No. 13, Conn.	Salvaged light vessel, adrift on rocks, in storm, and rescued men.
	Tender Larkspur.....	U. S. S. Indiana.....	Endeavored to pull off steamer ashore on East Bank Bay, N. Y.
	Tender Tulp.....	U. S. S. Pickering....	Towed disabled steamer to New London, Conn.
	Tender Pansy.....	Power boat; S. W. McKeever, U. S. Shipping Board.	Towed disabled and leaking boat to U. S. Government Dock, Rockaway Point.

SAVING OF LIFE AND PROPERTY BY VESSELS OR EMPLOYEES OF THE LIGHTHOUSE SERVICE DURING THE FISCAL YEAR 1918—Continued.

District.	Vessel or employee rendering service.	Vessel, etc., aided.	Nature of assistance.
3d.....	W. J. Murray, keeper, Paul Peterson, first assistant keeper, Stanley H. Roode, second assistant keeper, Little Gull Island Light Station, N. Y.	.....	Rescued man, adrift on ice, and nearly unconscious from exposure; took him to station, and afterwards sent him to hospital at Fort Michie.
	E. Hoxsie, keeper, Great Salt Pond, etc., Lights, R. I.	Schooner Francis....	Piloted schooner out of harbor.
	Quartermaster of Myrtle and quartermaster of Larkspur.	.....	Assisted in rescuing watchman of American Dock Co., who had fallen overboard, clinging to pile and exhausted.
	G. J. Thomas, keeper, Fire Island Light Station, N. Y.	.....	Assisted in extinguishing fire which burned several cottages, fishing buildings, etc.; also pulled from surf a floating ball resembling a mine.
	Tender John Rodgers.....	.....	Assisted in extinguishing fire which endangered clubhouse and part of Jersey Central Dock at Highlands.
	D. Griffiths, keeper, J. H. Bentley, assistant keeper, Southwest Ledge Light Station, Conn.	Motor launch Radime.	Towed disabled launch in rough sea to station.
	Fire Island Light Vessel No. 68, N. Y.	.....	Towed aeroplane with two occupants to ship.
	Five Fathom Bank Light Vessel No. 79, N. J.	Schooner Edna,....	Assisted in lifting anchor of waterlogged schooner when ready to be towed by tug.
	Northeast End Light Vessel No. 44, N. J.	.....	Towed disabled aeroplane to vessel and signaled for assistance.
	W. Tengren, keeper, Bullock Point Light Station, R. I.	Boat.....	Rescued 2 men and 2 women in danger of drowning, from capsized boat, and brought them to station.
	Tender Tulip.....	Barge Henry Failing, of New York.	Towed barge to Harbor of Refuge, Del., and anchored it behind breakwater.
4th.....	G. A. Holston, keeper, Lewes Lighthouse Depot, Del.	Barge Malne.....	Repaired disabled engine of barge during severe storm.
	.....do.....	Launch.....	Kept floating wreckage from damaging launch No. 66 during terrific storm.
	.....do.....	Navy S. P. No. 682..	Recovered disabled motor boat.
	Tender Iris.....	.....	Extinguished fire in an electric-welding machine, in close proximity to a barge containing 500 barrels of mineral oil.
	W. H. Schellenger, keeper, R. C. Taylor, first assistant keeper, Harbor of Refuge Light Station, Del.	Schooner Jesse L. Leach.	Rendered assistance to officers and crew of disabled schooner and furnished them food and shelter.
5th.....	Fenwick Island Shoal Light Vessel No. 52, Del.	Aeroplane.....	Rendered assistance to disabled aeroplane with 2 occupants.
	A. J. Jarvis, assistant keeper Maryland Point Light Station, Md.	.....do.....	Rendered assistance to disabled aeroplane with 1 occupant.
	Tender Maple.....	Hydroplane.....	Rendered assistance to disabled hydroplane with 1 occupant.
	C. B. Stowe, assistant keeper, Laurel Point Light Station, N. C.	Gas boat.....	Rendered assistance to gas boat caught in gale; also made repairs to boat.
	J. E. Stubbs, assistant keeper, Craney Island Light Station, Va.	Small boat.....	Rescued from drowning 3 young men whose boat capsized.
	W. F. McDorman, assistant keeper, Holland Island Bar Light Station, Md.	.....	Performed duty faithfully during severe ice conditions.
	A. Midgett, keeper Harbor Island Bar Light Station, N. C.	Schooner Admiral...	Assisted in floating schooner.
	E. Davis, keeper, J. M. Marchand, assistant keeper, Windmill Point Light Station, Va.	.....	Performed duty faithfully during hazardous ice conditions.
	I. C. Meekins, keeper, Croatan Light Station, N. C.	.....	Do.
	W. G. Rollinson, keeper, Hatteras Inlet Light Station, N. C.	Schooner A. L. White	Assisted in floating schooner; obtained medical treatment for member of crew.
	Tender Orchid.....	Tail of the Horse-shoe Light Vessel No. 46 and 35 Foot Channel Light Vessel No. 45, Va.	Rendered assistance to both light vessels during hazardous ice conditions.

SAVING OF LIFE AND PROPERTY BY VESSELS OR EMPLOYEES OF THE LIGHTHOUSE SERVICE DURING THE FISCAL YEAR 1918—Continued.

District.	Vessel or employee rendering service.	Vessel, etc., aided.	Nature of assistance.
5th.....	Tail of the Horseshoe Light Vessel No. 46, Va. C. W. Pugh, keeper, Roanoke Marshes Light Station, N. C. Tender Maple.....	..... Steamer E. R. Daniels. 2 large gas buoys....	Performed duty faithfully during hazardous ice conditions. Assisted steamer in getting out of ice and towed her to shore. Picked up 2 large gas buoys in Chesapeake Bay during hazardous ice conditions.
	Tender Juniper.....	.....	Extinguished fire which threatened to destroy tender.
	D. E. Christiansen, seaman, tender Juniper.	.....	Rendered courageous services in extinguishing fire on tender.
	Tender Jessamine.....	Schooner Otis Hubbard.	Rendered assistance to schooner caught in ice.
	Tender Maple.....	Schooner Mary Vickers.	Assisted in floating schooner.
	Tender Jessamine.....	Gasoline supply boat Speedway.	Floated gasoline supply boat.
	Tender Juniper.....	Schooner Annie Edwards.	Assisted in floating schooner from reef to safe anchorage.
	do.....	Schooner R. L. Davis	Floated schooner.
	O. O. Johnson, keeper, Cobb Point Barr Light Station, Md.	Motor boat.....	Rendered assistance to 5 persons in disabled motor boat.
6th.....	T. Knight, keeper, and C. Maloy, first assistant keeper, Hillsboro Light Station, Fla.	.....do.....	Assisted 2 men on board motor boat on rocks in Hillsboro Inlet, Fla., in getting boat off rocks and bringing her inside.
	T. Knight, keeper, Hillsboro Light Station, Fla.	Schooner Mary E. Suydam, of Patchogue, Long Island, N. Y.; F. A. Jofford, owner.	Assisted in supplying water, repairing rigging, and helping to get distressed vessel underway.
	A. F. Wichmann, keeper, L. R. Munn, second assistant keeper, Cape Romain Light Station, S. C.	Schooner Mary E. Suydam, of Patchogue, Long Island, N. Y.; F. A. Jofford, owner.	Rendered assistance to vessel aground off Cape Romain, remained with her until she floated, and furnished supplies.
	Tender Cypress.....	S. S. Mohawk, Clyde Steamship Co., New York, N. Y.	Recovered anchor and chain lost at entrance Charleston Harbor and delivered same to vessel's agent.
	C. P. Honeywell, keeper, Cape Canaveral Light Station, Fla.	Barge Louis H.; Taggart Coal Co., of Savannah, Ga., owners.	Assisted in caring for and keeping owners informed as to safety of barge left off station until tug returned.
	J. H. Carlin, keeper, and L. R. De Vaun, assistant keeper, Brunswick Harbor Lights, Ga.	.....	Rescued man from drowning in Brunswick Harbor, Ga.
	Tender Mangrove.....	Motor boat Dolphin, U. S. War Department.	Towed boat, disabled in Skull Creek, S. C., with company of soldiers and several officers aboard, to Fort Freemont, S. C.
	J. E. Swan, keeper, Mount Pleasant Rg. etc., Lights, S. C.	Motor boat.....	Furnished lodging and food to 2 men whose boat had sunk in Wando River, S. C.; recovered boat and towed it to Charleston, S. C.
	C. P. Honeywell, keeper, and O. F. Quarterman, second assistant keeper, Cape Canaveral Light Station, Fla.	Steamer Thames, of Wilmington, Del.	Answered distress signals and furnished transportation to mate and 1 seaman by launch to telephone and store where supplies were secured.
	Tender Water Lily.....	Motor boat, Catherine Davis, of Charleston, S. C.	Pulled excursion vessel with about 40 negroes on board off marsh, Dawho River, S. C.
	Tender Cypress.....	Hydroplane, U. S. Navy Department.	Picked up disabled hydroplane with 2 men about 10 miles southeast of Fowey Rocks Light Station, Fla.
	Tender Mangrove.....	Steamer Parismina; United Fruit Co., New York, N. Y., owners.	Assisted in pulling vessel off shoal in St. Johns River, Fla.
	Tender Cypress.....	S. S. Oak Branch.....	Picked up anchor and chain lost off entrance to Charleston Harbor, S. C., and delivered same to vessel's agent, Charleston, S. C.
7th.....	Tender Ivy.....	Schooner Brazos....	Rescued 4 men on a raft, adrift at North Key Shoal, Fla.
	Tender Snowdrop.....	Sea Wolf.....	Rendered valuable assistance to launch Sea Wolf, which had struck a reef in the vicinity of Fowey Rocks Light Station, Fla.

SAVING OF LIFE AND PROPERTY BY VESSELS OR EMPLOYEES OF THE LIGHTHOUSE SERVICE DURING THE FISCAL YEAR 1918—Continued.

District.	Vessel or employee rendering service.	Vessel, etc., aided.	Nature of assistance.
8th.....	Tender Camellia.....	Quarantine Station, Galveston, Tex.	Assisted in extinguishing fire.
	Tender Sunflower.....	U. S. Engineer Department coaling station, South Pass, La.	Assisted in extinguishing fire.
	J. D. Balsillie, keeper, Galveston Harbor Lights, Tex.	Sloop Edna, Houston, Tex.	Rendered assistance to man in boat; put him under sail.
	G. W. Bardwell, keeper, and M. Durabb, assistant keeper, Galveston Jetty Light Station, Tex.	Launch Texas Jack..	Rendered assistance to man in launch blown ashore.
	R. F. Steen, keeper, Cat Island Light Station, Miss.	Schooner Olga M., of Biloxi, Miss.	Gave medical attention to helpless man in boat.
	Tender Camellia.....	Catboat Opel.....	Rescued 5 men from capsized boat and took them on board tender.
	R. F. Steen, keeper, Cat Island Light Station, Miss.	Motor boat Havana, of Biloxi, Miss.	Rescued 2 men in helpless condition and furnished them lodging and dry clothes.
	C. T. Thomasen, assistant keeper, Head of Passes Light Station, La.	.....	Assisted engineers in extinguishing fire which threatened to destroy Government property near Cypress Range Front Light, La.
	R. F. Steen, keeper, Cat Island Light Station, Miss.	Motor launch Jane...	Rendered assistance to 5 men in boat, adrift; furnished them food and clothing.
	R. F. Steen, keeper, Cat Island Light Station, Miss.	Oyster schooner Josephine Lopez, of Biloxi, Miss.	Assisted crew of grounded schooner and brought them to Pass Christian, Miss., in station launch.
	R. F. Steen, keeper, Cat Island Light Station, Miss.	Schooner Algonquin, of New Orleans, La.	Assisted crew of grounded schooner and brought them to Pass Christian, Miss., in station launch.
	G. R. Smith and L. F. Smith, keeper and assistant keeper, Red Fish Bar Cut Light Station, Tex.	Motor launch.....	Furnished man in disabled boat food and shelter.
	H. A. Succow, keeper, Pass Manchac Light Station, La.	Motor launch Joe Hailey; Alfred Quillibear, owner.	Assisted man adrift in boat, and brought him to station.
	W. W. Bayly, keeper; M. W. Hamm, first assistant keeper; and B. S. Bayly, temporary laborer, Chandeleur Light Station, Miss.	.....	Maintained light and cared for Government property under adverse conditions during hurricane.
	E. Buras, laborer, Lighthouse Depot, Port Eads, La.	.....	Do.
	F. Hurd, keeper, Devils Point, etc., Lights, Fla.	.....	Maintained lights and cared for Government property under adverse conditions during hurricane.
	W. J. Doyle, keeper, Fort Barrancas Range Light Station, Fla.	.....	Do.
	J. W. St. G. Gibbon, keeper, and C. T. Thomasen, assistant keeper, Head of Passes Light Station, La.	.....	Do.
	A. E. Steimer, keeper, and W. D. Eiland, assistant keeper, Horn Island Light Station, Miss.	.....	Do.
	W. B. Thompson, keeper; R. L. Purcell, first assistant keeper; and H. H. Holdeman, second assistant keeper, Pensacola Light Station, Fla.	.....	Do.
	S. Gibbon, keeper, and W. F. Stephens, first assistant keeper, Sand Island Light Station, Ala.	.....	Do.
	L. F. Edgecombe, keeper, and S. Coludrovich, second assistant keeper, South Pass Range Rear Light Station, La.	.....	Do.
	J. B. Mason, keeper; J. W. Simmons, first assistant keeper; and A. Johnson, second assistant keeper, Southwest Pass Light Station, La.	.....	Do.
	Tender Magnolia.....	.....	Displayed excellent seamanship in proceeding to protected waters of Escambia Bay, where vessel rode out hurricane in safety.
10th.....	A. Shaw, jr., keeper, Presque Isle Light Station, Pa.	Yacht Invader.....	Provided shelter, food, and clothing for 3 men when yacht was driven ashore.

SAVING OF LIFE AND PROPERTY BY VESSELS OR EMPLOYEES OF THE LIGHTHOUSE SERVICE DURING THE FISCAL YEAR 1918—Continued.

District.	Vessel or employee rendering service.	Vessel, etc., aided.	Nature of assistance.
10th.....	R. Allen, keeper, Presque Isle Pierhead Light Station, Pa. C. H. Tucker, keeper, Oswego Light Station, N. Y.	Fishing tug Gannet. Sailing yacht.....	Assisted in extinguishing fire. Assisted in rescue of man who had fallen overboard one-fourth mile from light station.
11th.....	Tender Crocus..... C. Jonas, keeper, Manitou Light Station, Mich. L. Clark, first assistant keeper, and L. Hudak, third assistant keeper, Spectacle Reef Light Station, Mich. K. Olson, keeper, and F. E. Fredrickson, first assistant keeper, Stannard Rock Light Station, Mich. C. E. Richardson, keeper, Round Island Light Station (St. Marys River), Mich. W. A. Burke, keeper, Saginaw River Range Light station, Mich. W. G. Jilbert, keeper, Mendota Light Station, Mich.	Steamer War Fox... Motor boat; Frank Hill, owner. Motor boat Mary M.. Motor boat..... U. S. patrol boat S. P. 309. Motor boat; Dr. A. M. Warren, owner. Motor boat.....	Assisted stranded steamer. Rescued disabled motor boat, with 5 occupants, drifting onto rocks during storm. Towed disabled boat to station. Towed disabled boat 8 miles to station. Assisted in repairing disabled boat. Released stranded boat and towed it to safety. Rendered assistance to 3 fishermen whose launch had swamped in a heavy sea in the vicinity of the station.
12th.....	O. H. Knudson, keeper, and H. Schleif, first assistant keeper, Milwaukee Pierhead Light Station, Wis. C. S. Grenell, keeper, Chicago Pierhead Light Station, Ill. J. M. Robinson, keeper, Calumet Harbor Light Station, Ill. .....do..... C. W. Sanderson, keeper, Dunlap Reef Range Light Station, Wis. H. R. Bevry, keeper, and W. H. Nash, second assistant keeper, Wind Point Light Station, Wis. A. C. Erickson, keeper, Little Traverse Light Station, Mich. T. Robinson, keeper, Muskegon Light Station, Mich. R. W. Johnson, keeper, North Manitou Light Station, Mich. Tender Hyacinth..... C. E. Corlett, keeper, and W. Renier, assistant keeper, Manistique Light Station, Mich. C. J. Graan, keeper, Calumet Pierhead Light Station, Ill. F. A. Drew, keeper, Green Island Light Station, Wis. J. Napeizinski, keeper, and R. F. Wright, assistant keeper, Manitowoc Light Station, Wis. C. O. Butler, mechanic.....	Motor boat Dewey.. Gasoline launch Achaeaphal. Launch Bee, C. H. Larson, Chicago, owner. Sloop Dolphin; A. T. Lawrie, Milwaukee, Wis., owner. Cruiser Driad, of Racine, Wis. Tug Ida M. Stevens. Launch Teal..... Barge; Leathem & Smith, Sturgeon Bay, Wis., owners. Power boat Mary Ellen. Motor boat Maine... Barges, etc.....	Towed disabled motor boat to harbor. Assisted in rescuing a man who had fallen off the north pier. Towed launch, adrift with 2 people aboard, to station. Towed disabled and drifting launch to station. Rendered assistance to sloop in great danger of foundering. Rendered assistance to auxiliary cruiser grounded on reef. Rescued woman who had fallen into the water when getting out of a boat at dock. Rendered assistance to disabled tug and furnished dry clothing to 2 men on tug. Hauled launch, ashore north of fog-signal building, out of danger. Assisted in pulling barge off reef. Assisted district mechanic all day of each working day from Nov. 11 to 30, inclusive, besides standing their regular watches at night. Assisted in towing surfboat to the scene of the wreck of the power boat Mary Ellen. Towed disabled motor boat 3 miles. Assisted in search for bodies of 2 young persons drowned in the Manitowoc River and recovered body of 1. Secured 62 members for Red Cross while on vacation.
15th.....	Tender Oleander.....		Floated and towed 7 coal-laden barges to place of safety from point on bar in midstream where fleet had grounded; rescued 6 barges, including 4 U. S. Engineer Department steel barges, and other vessels, from ice and towed to safe harbor; transported stores and supplies to grounded steamer, and towed disabled gas boat and log raft to safe harbor.

SAVING OF LIFE AND PROPERTY BY VESSELS OR EMPLOYEES OF THE LIGHTHOUSE SERVICE DURING THE FISCAL YEAR 1918—Continued.

District.	Vessel or employee rendering service.	Vessel, etc., aided.	Nature of assistance.
16th.....	Tender Kukui..... Edmund Moore, keeper; C. E. Schulze, first assistant; and E. Teeter, second assistant, Scotch Cap Light Station, Alaska. D. O. Kinyon, keeper, Guard Island Light Station, Alaska. L. Amundsen, night watchman at Ketchikan Depot, Alaska; M. McDonough, seaman, Kukui. R. McKlem, keeper, and W. A. Shoemaker, assistant keeper, Eldred Rock Light Station, Alaska.	Schooner Olympic.. Cargo steamer Kotohera Maru, Kobe, Japan; Gunsiro Katsuda, owner. Fishing boat Mayflower. Launch.....	Towed disabled schooner to safe anchorage. Rendered assistance to 12 shipwrecked men, landed in heavy surf, and furnished them shelter. Towed disabled boat to Ketchikan. Rescued 4-year-old boy who fell into deep water from Lighthouse Dock. Furnished food and shelter to 2 men from disabled launch; took them to Fort Seward, 18 miles distant, in station launch, leaving lighthouse keeper alone at station for 3 days in bad weather.
	Tenders Farn and Cedar.....	S. S. Mariposa, Alaska S. S. Co.	Rendered assistance to wrecked steamer; transported officers, crew, passengers, baggage, etc., to Wrangell; picked up man and wife and furnished them subsistence and transportation to Shakan Bay Cannery, Alaska.
17th.....	B. B. Meagher, keeper, Smith Island Light Station, Wash. O. V. Brown, keeper, Browns Point Light Station, Wash.	Steamer Samson, Puget Sound Navigation Co.	Transported officer of disabled steamer by station boat, through rough sea, to get assistance. Rescued 3 Japanese from drowning near light station and furnished them clothing.
18th.....	W. A. Beeman, keeper; M. Cady, first assistant; and M. M. Palmer, second assistant, Point Loma Light Station, Cal. Tender Sequoia..... E. Wiborg, keeper, Trinidad Head Light Station, Cal.	Fish boat Pacific B-1. Silverado, Shipping Board vessel, loaned to Matson Navigation Co. Gasoline launch.....	Assisted in saving boat's cargo of fish. Picked up disabled steamer and assisted in towing it to shore. Rescued man in disabled launch.

DAMAGE BY COLLISIONS.

During the fiscal year there were 25 cases of collisions by vessels with aids to navigation, tenders and other lighthouse property, causing damages which have been repaired or paid for by the parties responsible therefor, or proper measures taken by the Lighthouse Service to compel payment by owners of the vessels where such owners or vessels were identified.

During the fiscal year there were three cases of collisions, in which vessels of the Lighthouse Service were found to have been responsible for damage to other vessels, or property. Adjustment of claims resulting from these collisions, in the total amount of \$189.33 has been made and report submitted to Congress under the provisions of section 4 of the act of June 17, 1910 (36 Stat. 537).

PUBLICATIONS OF THE LIGHTHOUSE SERVICE.

[All publications are at present distributed free.]

Publications.	Date of last edition.	Cost of last edition.	Number distributed.
Light lists:			
Atlantic and Gulf coasts of United States.....	Jan. 1, 1918	\$4,295	10,538
Pacific coast of United States, etc.....	.....do.....	813	2,241
Great Lakes of United States and Canada.....	Apr. 1, 1918	1,030	1,198
Upper Mississippi River and tributaries.....	Jan. 15, 1918	558	773
Ohio River and tributaries.....	Sept. 15, 1917	128	905
Lower Mississippi River and tributaries.....	Nov. 15, 1917	173	794
Buoy lists:			
First district.....	May 1, 1918	888	4,444
Second district.....	June 1, 1918	757	4,301
Third district.....	May 15, 1918	731	5,084
Fourth district.....	June 1, 1917	335	4,505
Fifth district.....	May 15, 1918	901	3,825

PUBLICATIONS OF THE LIGHTHOUSE SERVICE—Continued.

Publications.	Date of last edition.	Cost of last edition.	Number distributed.
Buoy lists—Continued.			
Sixth district.....	May 1, 1918	\$387	2,608
Seventh district.....	do	474	2,745
Eighth district.....	Sept. 1, 1916	704	3,744
Ninth district.....	May 15, 1918	27	
Tenth district.....	Apr. 1, 1917	211	1,432
Eleventh district.....	do	531	1,269
Twelfth district.....	do	349	1,310
Sixteenth district.....	June 1, 1918	262	452
Seventeenth district.....	do	468	907
Eighteenth district.....	do	229	919
Nineteenth district.....	Apr. 1, 1918	20	20
Miscellaneous publications:			
Weekly Notice to Mariners.....	1918	3,051	226,950
Annual Report, Commissioner of Lighthouses.....	1917	605	1,484
Regulations for the United States Lighthouse Service.....	1918	619	447
Medical handbook.....	1915	633	68
Lighthouse Service bulletins.....	1918	229	18,000
Regulations for lighting bridges.....	1915	202	206
Regulations for uniforms.....	1912	70	28
Civil-service regulations.....	1913	73	82
Instructions for cost keeping.....	1914	120	35
Instructions to employees.....	1915	408	47
The United States Lighthouse Service.....	1915	505	63

COST OF PRINTING FOR THE LIGHTHOUSE SERVICE DURING THE FISCAL YEAR 1918.

Light lists.....	\$7,295.53
Buoy lists.....	6,483.79
Notices to mariners.....	3,128.64
Annual report.....	604.55
Specifications and other publications.....	968.46
Forms, reports, record books, etc.....	6,385.81
Total.....	24,866.78

The following amounts were received by the Lighthouse Service during the year and turned into the Treasury: From sales of property, \$14,956.55; from damages to aids to navigation and other property, \$4,485.77; from leases and rentals, \$5,434.50.

APPROPRIATIONS FOR THE BUREAU OF LIGHTHOUSES AND THE LIGHTHOUSE SERVICE, SIXTY-FIFTH CONGRESS, FIRST AND SECOND SESSIONS, 1917-18.

Title	Act.	Amount.
Maintenance:		
Salaries, Bureau of Lighthouses, 1919.....	Legislative, July 3, 1918.....	\$65,430
General expenses, Lighthouse Service, 1919.....	Sundry civil, July 1, 1918.....	3,500,000
Salaries of keepers of lighthouses, 1919.....	do.....	910,000
Salaries, lighthouse vessels, 1919.....	do.....	1,265,000
Salaries, Lighthouse Service, 1919.....	do.....	380,000
Total for maintenance.....		6,150,430
Special works:		
Nantucket Harbor Fog Signal, Mass.....	Urgent deficiency, Mar. 28, 1918.....	15,000
Staten Island Lighthouse Depot, N. Y. (wharves).....	do.....	60,000
Repairing and rebuilding aids to navigation, Gulf of Mexico.....	do.....	100,000
Repairing and rebuilding aids to navigation, Atlantic coast.....	do.....	150,000
Aids to navigation, Guantanamo Bay, Cuba.....	Sundry civil, July 1, 1918.....	14,000
Depot for second lighthouse district.....	do.....	85,000
Detroit Lighthouse Depot, Mich.....	do.....	53,000
Sand Island Light Station, Ala.....	do.....	37,000
Spectacle Reef Light Station, Mich.....	do.....	28,000
Ambrose Channel Lighted Buoys, N. J.....	do.....	25,000
Fifth lighthouse district, gas buoys.....	do.....	65,000
Depot for sixteenth lighthouse district.....	do.....	90,000
Total for special works.....		723,000
Grand total.....		6,873,430

EXPENDITURES DURING THE FISCAL YEAR 1918 FROM APPROPRIATIONS FOR THE LIGHTHOUSE SERVICE.

(Obligations incurred are not included.)

Salaries:	
Bureau of Lighthouses, 1917.....	\$2, 632. 15
Bureau of Lighthouses, 1918.....	57, 044. 64
Salaries of keepers of lighthouses:	
1917.....	93, 570. 66
1918.....	909, 487. 55
Salaries, lighthouse vessels:	
1917.....	125, 511. 24
1918.....	1, 180, 901. 65
Salaries, Lighthouse Service:	
1917.....	4, 142. 58
1918.....	362, 789. 94
General expenses, Lighthouse Service:	
1916.....	217, 232. 52
1917.....	834, 490. 06
1918.....	2, 467, 450. 46
Total maintenance.....	6, 255, 253. 45

SPECIAL WORKS.

General:	
Repairing and rebuilding aids to navigation, Atlantic coast.....	29, 647. 74
Tender for first lighthouse district.....	2, 968. 90
Light vessels for general Lake service.....	112. 22
Light vessels for general service.....	6, 938. 28
Lighthouse tender, general service.....	59, 446. 08
Radio installations on lighthouse tenders.....	23. 12
Oil houses for light stations.....	12. 55
Claims for damages by collision with lighthouse vessels.....	181. 38
Second district:	
Cape Cod Canal Lights, Mass.....	2, 176. 58
Woods Hole Lighthouse Depot, Mass.....	14, 586. 82
Third district:	
Staten Island Lighthouse Depot, N. Y. (office).....	10. 04
Staten Island Lighthouse Depot, N. Y. (wharves).....	12. 54
Aids to navigation, Hudson River, N. Y.....	1, 995. 98
Aids to navigation, East River, N. Y.....	1, 326. 00
Tender for third lighthouse district.....	72. 37
Fourth district:	
Aids to navigation, Delaware River, Pa. and Del.....	34, 169. 93
Fifth district:	
Thimble Shoal Light Station, Va.....	3, 867. 64
Lighting Norfolk Harbor, Va.....	1, 720. 00
Aids to navigation, Chesapeake Bay, Md. and Va.....	1, 201. 80
Sixth district:	
Tender for engineer, sixth lighthouse district.....	2, 338. 01
Aids to navigation, St. Johns River, Fla.....	13, 606. 34
Seventh district:	
Aids to navigation, Florida Reefs, Fla.....	2, 300. 56
Eighth district:	
Aransas Pass Light Station, Tex.....	5. 75
Galveston Jetty Light Station, Tex.....	51. 95
Southwest Pass Light Vessel, Mississippi River, La.....	521. 70
Aids to navigation, Atchafalaya Entrance Channel, La.....	5, 757. 92
Repairing and rebuilding aids to navigation, Gulf of Mexico.....	110, 399. 23
Ninth district:	
Navassa Island Light Station, West Indies.....	2, 291. 38
Tenth district:	
Aids to navigation, Ashtabula Harbor, Ohio.....	1, 070. 88
Aids to navigation, Lorain Harbor, Ohio.....	891. 73
Aids to navigation, Conneaut Harbor, Ohio.....	23, 461. 50
Aids to navigation, Toledo Harbor, Ohio.....	13, 085. 31
Aids to navigation, Fairport Harbor, Ohio.....	400. 00
Aids to navigation, Huron Harbor, Ohio.....	11. 84

Eleventh district:

Aids to navigation, Fighting Island Channel, Detroit River, Mich.	\$8,686.46
Detroit River Lights, Mich.	5,825.00
Superior Pierhead Range Lights, Wis.	1,193.82
Aids to navigation, Ashland, Wis.	56.20
Sand Hills Light Station, Mich.	29,941.08
Aids to navigation, Keweenaw Waterway, Mich.	15,579.69

Twelfth district:

White Shoal Light Station, Lake Michigan.	780.00
Chicago Harbor Light Station, Ill.	55,037.14
Manitowoc Breakwater Light Station, Wis.	964.23
Aids to navigation, Indiana Harbor, Ind.	28.00

Sixteenth district:

Aids to navigation, Alaska.	39,674.38
Cape St. Elias Light Station, Alaska.	907.02

Seventeenth district:

Aids to navigation, Puget Sound, Wash.	8,671.73
Kellett Bluff Light Station, Wash.	2,220.30
Aids to navigation, Wash. and Oreg.	4,438.81

Nineteenth district:

Aids to navigation, Pearl Harbor, Hawaii.	11,620.44
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Total, special works..... 522,288.37

Total, maintenance appropriations..... 6,255,253.45

Total, special works..... 522,288.37

Grand total..... 6,777,541.82

ITEMIZED ESTIMATES OF APPROPRIATIONS FOR THE FISCAL YEAR 1920, AND ITEMIZED STATEMENT OF EXPENDITURES FOR THE FISCAL YEAR 1918, AS REQUIRED BY THE ACT OF CONGRESS APPROVED JUNE 25, 1910 (36 STAT., 755).

[The expenditures herein stated are in part estimated, owing to the fact that all obligations incurred for the year 1918 have not yet been settled. Articles of supplies purchased for general stock have also been distributed, approximately, to features to be benefited. This table refers to appropriations made in the sundry civil appropriation act and does not include Bureau salaries in Washington nor the cost of publications, otherwise provided for. This statement contains also amounts for salaries and wages under certain items which are shown separately in the Book of Estimates, 1920.]

Item.	Estimate, 1920.	Expenditures, 1918.	Item.	Estimate, 1920.	Expenditures, 1918.
GENERAL EXPENSES, LIGHTHOUSE SERVICE.			GENERAL EXPENSES, LIGHTHOUSE SERVICE—continued.		
Lights and fog signals:			Buoys:		
Rations and provisions.....	\$247,700	\$156,862	Establishment.....	\$145,000	\$118,722
Fuel and rent for keepers....	79,000	63,889	Supplies.....	33,000	27,104
General supplies.....	296,000	237,559	Repairs.....	39,500	68,101
Repairs and improvements, including grounds and outbuildings.....	234,200	246,267	Incidental expenses.....	2,000	1,757
Establishing lights and fog signals, including sites....	29,000	20,010	Tenders:		
Necessary additional land for light stations.....	1,500		Rations and provisions.....	292,000	235,590
Oil and carbide houses.....	1,550	7	Supplies.....	575,000	460,762
Incidental expenses.....	12,500	10,001	Repairs.....	757,500	264,673
Daymarks and spindles:			Incidental expenses.....	9,000	7,726
Establishment, including sites.....	2,000	2,209	Light vessels:		
Repairs and improvements.	7,100	4,932	Rations and provisions.....	157,000	117,338
Incidental expenses.....	200		Supplies.....	165,000	132,788
Post lights:			Repairs.....	247,200	124,332
Establishment.....	2,000	2,237	Incidental expenses.....	3,000	2,461
Wages of laborers attending lights.....	268,600	242,807	Depots:		
Supplies.....	27,000	21,880	Pay of laborers and mechanics.....	90,000	71,100
Repairs and improvements.	27,500	19,482	Rent.....	5,000	5,120
Incidental expenses.....	250	171	Repairs and improvements.	157,500	145,229
			Incidental expenses.....	17,000	13,829
			Offices:		
			Technical books and periodicals.....	500	254

ITEMIZED ESTIMATES OF APPROPRIATIONS FOR THE FISCAL YEAR 1920, AND ITEMIZED STATEMENT OF EXPENDITURES FOR THE FISCAL YEAR 1918—Continued.

Item.	Estimate, 1920.	Expenditures, 1918.	Item.	Estimate, 1920.	Expenditures, 1918.
GENERAL EXPENSES, LIGHTHOUSE SERVICE—continued.			SALARIES, LIGHTHOUSE VESSELS.		
Offices—Continued.			Salaries and wages, lighthouse tenders.....	\$1,201,800	\$763,150
Stationery and office supplies.....	\$13,000	\$10,631	Salaries and wages, light vessels.....	678,200	417,677
Telegraph and telephone....	0,000	6,112	Total.....	1,880,000	1,180,827
Traveling expenses and mileage.....	26,000	21,024	Appropriation, 1919, \$1,265,000.		
Rent.....	3,000	2,714	Appropriation, 1918, \$1,104,650.		
Freight, expressage, and cartage.....	18,000	14,596	SALARIES, LIGHTHOUSE SERVICE.		
Incidental expenses.....	3,000	2,465	Salaries, executive and technical.....	154,900	134,100
Total.....	4,000,000	2,882,751	Salaries, clerical and messenger.....	164,340	140,654
Appropriation, 1919, \$3,500,000.			Salaries, authorized depot force.....	113,760	88,300
Appropriation, 1918, \$2,850,000.			Total.....	433,000	363,054
SALARIES OF KEEPERS OF LIGHTHOUSES.			Appropriation, 1919, \$380,000.		
Salaries of lighthouse keepers..	1,321,600	909,490	Appropriation, 1918, \$380,000.		
Appropriation, 1919, \$940,000.					
Appropriation, 1918, \$940,000.					

NOTE.—The expenditures shown include reimbursements from Navy Department for part of maintenance expenses of vessels and stations transferred temporarily to Navy by Executive order. Under appropriation "General expenses, Lighthouse Service," it is proposed during the fiscal year 1919 to authorize per diem in lieu of subsistence, pursuant to the act of August 1, 1914, at rates of from \$2 to \$4.

SUMMARY OF ESTIMATES OF APPROPRIATIONS FOR THE LIGHTHOUSE SERVICE FOR THE FISCAL YEAR 1920.

FOR GENERAL MAINTENANCE OF THE LIGHTHOUSE SERVICE.

Salaries, Bureau of Lighthouses.....	\$69,030
General expenses, Lighthouse Service.....	4,000,000
Salaries, Lighthouse Service.....	433,000
Salaries, keepers of lighthouses.....	1,321,600
Salaries, lighthouse vessels.....	1,880,000
Retired pay, Lighthouse Service.....	50,000
Total.....	7,753,630

FOR SPECIAL WORKS.

Group 1. Works urgently necessary for the safety or immediate needs of navigation and for the preservation of existing structures or equipment, for the full utilization of other public improvements, or for the efficient equipment of the Lighthouse Service:

1. Constructing or purchasing and equipping tenders and light-vessels.....	760,000
2. Hawaiian Islands Lighthouse Depot, construction and equipment	120,000
3. Light-keepers' dwellings, construction.....	75,000
4. Lighthouse depot for fifth district, enlargement, improvement, or establishment of new depot.....	275,000
5. St. Marys River, Mich., aids to navigation.....	80,000
6. Staten Island Lighthouse Depot, N. Y., improvements.....	45,000
7. Virgin Islands, West Indies, aids to navigation.....	50,000
8. Staten Island Lighthouse Depot, N. Y., improvement and extension of wharves.....	65,000
9. Potomac River, Md., aids to navigation.....	95,000
10. Lighthouse depot for eighth district, construction.....	88,500

NOTE.—All of the foregoing items have been authorized by law, wholly or in part.

Group 1. Works urgently necessary for the safety or immediate needs of navigation and for the preservation of existing structures or equipment, for the full utilization of other public improvements, or for the efficient equipment of the Lighthouse Service—Continued.

11. Riprap, etc., for 39 light stations, third district.....	\$284,000
12. Charleston Lighthouse Depot, S. C., improvements.....	115,000
13. Lighthouse depot for seventh district, establishing.....	200,000
14. Alaska, establishing new aids and improving existing aids.....	75,000
15. Ludington, Mich., aids to navigation.....	50,000
16. Tampa Bay, Fla., aids to navigation.....	17,500
17. Delaware Bay entrance, improvement of aids to navigation.....	148,500
18. Goose Island Flats, N. J., establishment of light and fog signal station.....	140,000
19. California and Nevada, aids to navigation.....	37,775
20. Goat Island Lighthouse Depot, Cal., improvement.....	16,500
Authorized by law.....	\$1,608,500
Not authorized.....	1,129,275

Total, group 1.....	2,737,775
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Group 2. Works considered essential for the needs of navigation and the equipment of the Lighthouse Service, and which it is recommended be undertaken as resources permit, are submitted with estimates of cost. (These items have been selected from a much larger number of recommendations submitted by the superintendents of the lighthouse districts and others.)

21. Point Pinos Light Station, Cal., improvement.....	37,500
22. Michigan Island, Wis., establishment of light and fog-signal station.....	85,000
23. Kauhola Point Light Station, Hawaii, improvement.....	20,000
24. Anacapa Island, Cal., establishment of light and fog-signal station.....	115,000
25. Santa Barbara Light Station, Cal., improvements.....	33,000
26. Cape Spencer, Alaska, establishment of light and fog-signal station.....	145,000
27. Staten Island Lighthouse Depot, N. Y., dry dock.....	200,000
28. Portage Lake, Mich., establishment of light and fog-signal station and improvement of aids.....	100,000
29. Ram Island, Me., establishment of light.....	5,400
30. Cape Kumukahi, Hawaii, establishment of light.....	22,000
31. Henderson Point, Me., establishment of light and fog signal.....	7,500
32. Port Real, P. R., establishment of light station.....	40,000
33. Nine Mile Point, Mich., establishment of light and fog-signal station.....	50,000
34. Caribbean Sea, aids to navigation ^a	75,000
35. Galveston Jetty Light Station, Tex., improvements.....	8,500
36. Grays Harbor Light Station, Wash., improvements.....	15,000
37. Newport, R. I., or vicinity, depot, etc.....	82,300
38. Lake Champlain, N. Y. and Vt., improvements.....	150,000
39. Sag Harbor, N. Y., improvements.....	45,700
40. Manitowoc, Wis., improvements.....	16,000
41. Alaska, improvements.....	70,000

Total, group 2 (not included in total of estimates).....	1,322,900
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RECAPITULATION.

For general maintenance of the Lighthouse Service.....	7,753,630
For special works: Group 1.....	2,737,775
Total.....	10,491,405

^a Upon the recommendation of the Secretary of Commerce an allotment of \$100,000 has been made by the President, from the appropriation for national security and defense, for the project covered by Item No. 34.

DETAILED ESTIMATES FOR MAINTENANCE, 1920.

BUREAU OF LIGHTHOUSES.

Salaries..... \$69,030

GENERAL EXPENSES, LIGHTHOUSE SERVICE.

For supplies, repairs, maintenance, and incidental expenses of lighthouses and other lights, beacons, buoyage, fog signals, lighting of rivers heretofore authorized to be lighted, light vessels, other aids to navigation, and lighthouse tenders, including the establishment, repair, and improvement of beacons and day marks and purchase of land for same; the establishment of post lights, buoys, submarine signals, and fog signals; the establishment of oil or carbide houses not to exceed \$10,000: *Provided*, That any oil or carbide house erected hereunder shall not exceed \$550 in cost; the construction of necessary outbuildings at a cost not exceeding \$500 at any one light station in any fiscal year; the improvements of grounds and buildings connected with light stations and depots; restoring light stations and depots and buildings connected therewith: *Provided*, That such restoration shall be limited to the original purpose of the structures; wages of laborers attending post lights; pay of temporary employees and field force while engaged on works of general repair and maintenance and pay of laborers and mechanics at lighthouse depots; rations and provisions or commutation thereof for keepers of lighthouses, working parties in the field, officers and crews of light vessels and tenders, and officials and other authorized persons of the Lighthouse Service on duty on board of such tenders or vessels; and money accruing from commutation for rations and provisions for the above-named persons on board of tenders and light vessels or in working parties in the field may be paid on proper vouchers to the person having charge of the mess of such vessel or party, reimbursement under rules prescribed by the Secretary of Commerce of keepers of light stations and masters of light vessels and of lighthouse tenders for rations and provisions and clothing furnished shipwrecked persons who may be temporarily provided for by them, not exceeding in all \$5,000 in any fiscal year; fuel and rent of quarters where necessary for keepers of lighthouses; the purchase of land sites for fog signals; the rent of necessary ground for all such lights and beacons as are for temporary use or to mark changeable channels and which in consequence can not be made permanent; the rent of offices, depots, and wharves; traveling expenses, mileage, library books for light stations and vessels, and technical books and periodicals not exceeding \$1,000; traveling and subsistence expenses of teachers while actually employed by States or private persons to instruct the children of keepers of lighthouses; and for all other contingent expenses of district offices and depots and not exceeding \$8,500 for contingent expenses of the Office of the Bureau of Lighthouses in Washington, \$4,000,000.

NOTE.—The amount estimated for is \$500,000 in excess of the appropriation for the fiscal year 1919, made necessary on account of the general expansion of the Service and the great advance in the cost of all commodities and services.

An increase of appropriation is considered necessary on account of the increase in numbers of aids required for the safety of navigation, to keep the Lighthouse Service in an economical state of repair and efficiency, and because of the recent extraordinary advance in the price of labor and materials. The total number of aids was increased in 1918 from 15,227 to 15,673, an increase of 446, or 2.9 per cent. In order to keep pace with the constant development of commerce it is believed that proper provision for maintenance and repair as well as for the establishment of necessary additional minor aids frequently requested by mariners should be made. With the increasing numbers of requests for aids, it is impossible to render the full efficiency and service demanded unless adequate provision is made for funds. It has been found necessary to estimate on a 30 per cent increase for all items in the appropriations covering the purchase of supplies and materials, due to the continued steady general advance in prices. It is, therefore, believed that the additional amount requested is conservative in view of the circumstances.

SALARIES, KEEPERS OF LIGHTHOUSES.

For salaries of not exceeding 1,800 lighthouse and fog-signal keepers and laborer attending lights, exclusive of post lights, \$1,321,600.

NOTE.—The foregoing estimates of appropriation call for an increase of \$381,600 over the appropriation of \$940,000 made for this purpose for the fiscal year 1919, and is based on the increase authorized by act of June 20, 1918, which provided for an average salary of \$840 for keepers of lighthouses.

(See p. 58 for itemized estimate.)

SALARIES, LIGHTHOUSE VESSELS.

For salaries and wages of officers and crews of light vessels and lighthouse tenders, including temporary employment when necessary, \$1,880,000.

NOTE.—The amount estimated for is \$615,000 in excess of the appropriation for the fiscal year 1919, and is caused by the unprecedented situation in shipping conditions, making it quite impossible to obtain seamen, firemen, cooks, etc., at the former recognized standard rates of pay. The foregoing estimate is based on standard pay schedules now followed on the various coasts. A further and fuller statement of this situation is found in this report at p. 23.

(See p. 58 for itemized estimate.)

SALARIES, LIGHTHOUSE SERVICE.

For salaries of 17 lighthouse superintendents, and of clerks and other authorized permanent employees in the district offices and depots of the Lighthouse Service, exclusive of those regularly employed in the office of the Bureau of Lighthouses, Washington, D. C., \$433,000.

NOTE.—An increase of \$53,000 over the appropriation for the fiscal year 1919 is submitted, consisting of the following:

To pay the increase in the compensation of superintendents of lighthouses, authorized by act of June 20, 1918, 16 superintendents, at \$600.....	\$9,600
Additional employees (2 clerks, 1 assistant superintendent, 2 watchmen, and 1 assistant depot keeper).....	7,000
Proposed increases in the pay of technical and clerical employees, especially the lower-paid positions, in order to meet the general advance in compensation.....	36,400
Total.....	53,000

The item of \$7,000 is occasioned by the general growth of the service in order that work of the districts may be dispatched promptly.

RETIRED PAY, LIGHTHOUSE SERVICE.

For retired pay of officers and employees, Lighthouse Service, \$50,000.

NOTE.—The act of June 20, 1918, provides, "That hereafter all officers and employees engaged in the field service or on vessels of the Lighthouse Service, except persons continuously employed in district offices or shops, who shall have reached the age of sixty-five years, after having been thirty years in the active service of the Government, may at their option be retired from further performance of duty; and all such officers and employees who shall have reached the age of seventy years shall be compulsorily retired from further performance of duty: *Provided*, That the annual compensation of persons so retired shall be a sum equal to one-fortieth of the average annual pay received for the last five years of service for each year of active service in the Lighthouse Service or in a department or branch of the Government having a retirement system, not to exceed in any case thirty-fortieths of such average annual pay received: *Provided further*, That such retirement pay shall not include any amount on account of subsistence or other allowance."

There are 102 persons in the Lighthouse Service over 70 years of age embraced in the above act, whose retirement pay totals \$37,640.28, and 38 persons entitled to optional retirement whose total retirement pay amounts to \$29,628.21. The amount estimated for the fiscal year 1920 is based on the full retired pay of persons over 70 years of age, and an estimated amount of \$12,359.72 for persons entitled to optional retirement and desiring same, and for additional persons who will reach the compulsory retirement age during the year for which the estimate is submitted.

DETAILED ESTIMATES FOR SPECIAL WORKS, 1920.

GROUP No. 1.

Works urgently necessary for the safety or immediate needs of navigation and for the preservation of existing structures or equipment, for the full utilization of other public improvements, or for the efficient equipment of the Lighthouse Service.

No. 1. *Tenders and light vessels for third, fifth, and eighth lighthouse districts, or in the Lighthouse Service generally.*—For constructing or purchasing and equipping lighthouse tenders, to replace those worn out in service, in the third and fifth lighthouse

districts, and a light vessel for the eighth lighthouse district, or in the Lighthouse Service generally, \$760,000.

NOTE.—The act of June 20, 1918, authorized \$760,000 for these vessels, but no appropriation has been made therefor. There are two tenders in the third and two in the fifth district, namely, the *John Rodgers*, *Mistletoe*, *Jessamine*, and *Holly*, that are old and of obsolete type, and should be replaced as soon as practicable by modern, efficient vessels. These tenders, to be kept in commission, require repairs that are not warranted by their age, condition, and the service obtained from them.

There is urgent need of a light vessel at South Pass, Gulf Coast, La., similar to the light vessel at Southwest Pass, as both passes are open and in use by mariners.

No. 2. Hawaiian Islands Lighthouse Depot.—For constructing and equipping a lighthouse depot at Honolulu, Hawaii, \$120,000.

NOTE.—The act of August 28, 1916 (39 Stat., 538), authorized \$90,000 for this work, but no appropriation was made therefor. The greatest need in this district is an adequate lighthouse depot. At present the stores are kept in two small, overcrowded, leaky storerooms on the Channel Wharf, Honolulu, where they are in danger of fire on account of proximity to fishing sampans, which are careless in the handling of gasoline. The heavy stores are kept in a large room adjoining the storage rooms occupied as a depot on Channel Wharf, lately vacated by the Territory because of the condemnation of the wharf. Buoys are kept some on Channel Wharf and some on War Department Wharf No. 1. The heavier buoys can not be kept on the Channel Wharf on account of its dilapidated condition, and when placed on the dock are exposed to the weather, and are frequently covered with coal when warships are coaling. In assembling materials for any construction work it has been the custom to collect them at the Channel Wharf, and if there is any considerable amount that wharf becomes filled up, necessitating the removal of the material on account of inconvenience to other users. Hence, the lack of a depot results in much inefficiency in collecting materials as well as inconvenience and annoyance. The fact that the temporary wharf and storehouse are in a bad state of repair, having been condemned some years ago, makes the situation very uncertain and unsatisfactory.

It is proposed to erect adequate buildings and improvements on this site for lighthouse depot purposes. The increase in the estimate over the amount authorized by act of August 28, 1916, is due to the great advance in materials and labor since that date. Detailed estimate:

Improvements and enlargement of wharf.....	\$40,000
General storehouse.....	32,250
Buoy wharf, Sand Island.....	10,800
Oil house.....	1,800
Buoy repair and carpenter shop sheds.....	3,900
Improvement of grounds, including walks, fences, etc.....	1,350
Machine and blacksmith shop.....	8,600
Shop equipment, etc.....	6,000
Keeper's dwelling.....	4,500
Buoy shed, Sand Island.....	10,800
Total.....	120,000

No. 3. Light-keepers' dwellings.—For light-keepers' dwellings and appurtenant structures, including sites therefor, within the limit of cost fixed by act approved February 26, 1907 (34 Stat., 996), \$75,000.

NOTE.—The act of August 28, 1916 (39 Stat., 537), authorized this work, but no appropriation was made therefor. The appropriations made March 4, 1907 (34 Stat., 1319), and May 27, 1908 (35 Stat., 334), of \$75,000 each, are now exhausted, but dwellings at a number of stations are yet needed, among which may be stated: Amelia Island, Fla.; Ano Nuevo Island, Cal.; Buffalo Breakwater, N. Y.; Charlotte, N. Y.; Diamond Head, Hawaii; Dry Tortugas, Fla.; Frankfort, Mich.; Ludington Breakwater, Mich.; Oswego Breakwater, N. Y.; Piedras Blancas, Cal.; Point Hueneme, Cal.; Point Montara, Cal.; Point Sur, Cal.; Port Eads, La.; Port San Juan, P. R.; Poverty Island, Mich.; Robinson Point, Wash.; Sand Island, Ala.; Tawas, Mich.; Toledo Harbor, Ohio; Two Harbors, Minn.; Cove Point, Md.; Point Lookout, Md.; Bodie Island, N. C.; Point Jiguero, P. R.; Wingo Neck, Buzzards Bay, Mass. Detailed estimate:

16 dwellings, at \$4,500.....	\$72,000
Contingencies.....	3,000
Total.....	75,000

No. 4. Depot for fifth lighthouse district.—For enlarging and improving the lighthouse depot at Portsmouth, Va., in the fifth lighthouse district, or for establishing a new depot, \$275,000.

NOTE.—The act of June 20, 1918, authorized this work, but no appropriation was made therefor. The present lighthouse depot at Portsmouth, Va., is entirely inadequate to the needs of the fifth district, both in area and in waterfront. This is the principal depot of one of the largest lighthouse districts and is the headquarters for five tenders and two light vessels during the greater part of the year. The aggregate length of these vessels is over 1,000 feet; the total wharf frontage is only 445 feet, of which over 200 feet is in a narrow slip available for small light-draft vessels only. The operation of tenders is much hampered by this limited frontage, the delay caused by waiting to discharge or receive cargo being estimated to cost the Lighthouse Service not less than \$25,000 a year; and now that the tenders are under the jurisdiction of the Navy Department, increased facilities are an urgent military necessity. The very small area available for buoy storage necessitates much otherwise unnecessary handling of heavy buoys and appendages at large cost of time and money. The available wharf frontage of this depot should be doubled, and the area increased by from 4 to 6 acres. This may be done by purchase of a new and larger site, or by purchase of adjacent property. The present buildings are mainly antiquated wooden structures. They constitute a fire menace and should be replaced by modern fireproof buildings. Detailed estimate:

Purchase of water-front property.....	\$125,000
Construction of wharf.....	53,700
Filling, grading, and paving.....	41,250
Storehouse, coal shed, machine, blacksmith, and carpenter shops.....	32,000
Water mains, fire-protection system, and traveling electric crane.....	8,900
Lighting system and generating plant.....	5,150

Buoy skids and chain platform.....	\$4,000
Miscellaneous equipment.....	5,000
Total.....	275,000

No. 5. *St. Marys River, Mich., aids to navigation.*—For improving and repairing existing aids to navigation and for establishing and moving aids as required to best serve the needs of navigation in St. Marys River, Mich., and vicinity, \$80,000.

NOTE.—The act of June 20, 1918, authorized this work, but no appropriation was made therefor. To properly mark the main channel through the St. Marys River between Detour and Point Iroquois, lights are maintained on some 71 distinct structures, exclusive of floating aids. Forty-five of these structures are on submarine sites, completely surrounded by water and subject to great damage by ice action at the opening of navigation each season. During the past two seasons six structures have been completely destroyed by the ice and two more so badly damaged as to require complete reconstruction. In addition, many more have been damaged to so great an extent as to make a large expenditure necessary for their proper repair. These latter structures are in such condition as to make their complete destruction probable unless repairs are made at a very early date. This work of reconstruction and repair should be undertaken at once, and in addition there are numerous improvements to aids in this locality that will materially add to their effectiveness and in many cases result in a considerable saving in maintenance cost that should be carried out at the same time that general repairs, etc., are made. This is one of the most important sections of the Great Lakes waterway, and it is essential that the aids to navigation be maintained in the highest possible state of efficiency. Estimate of cost:

Repairs to foundations of existing structures.....	\$33,500
Repairs and renewals to superstructures of existing structures.....	10,400
New buoys.....	7,500
New establishments and relocation of existing aids.....	10,700
Improvements to illuminating apparatus.....	17,900
Total.....	80,000

No. 6. *Staten Island Lighthouse Depot, N. Y.*—For extending and enlarging the machine shop at the general lighthouse depot, Tompkinsville, Staten Island, N. Y., \$45,000.

NOTE.—The act of June 20, 1918, authorized \$30,000 for this work, but no appropriation was made therefor. The present machine shop is so constructed as to be unadaptable for the work to be done in it. It will have to be extended and enlarged before it can be made an efficient and economical shop. The interior is divided into small narrow rooms, one story high, so that it is impossible to install any large machinery or a traveling crane, making it necessary to handle all work by hand. The windows are small and so arranged that the shop is dark in practically all parts except close to them. Moreover, the general construction is such that it is almost impracticable and very uneconomical to rearrange the old shop so as to be in any way convenient or efficient. The proposed improvements include an extension on the west side, three stories high, with windows properly located, having a large open room without partitions, the center of the second floor to be omitted to permit installation of traveling cranes for handling all heavy machinery, and the first floor to be so arranged that heavy machinery can be installed in such positions as to be accessible to the cranes. With this extension completed, the old shop can be used as a storehouse for casting metals, etc., which are used in connection with the machine-shop work, these being now stored in a separate building, which is an inconvenient and uneconomical arrangement. This will also release storage space for other supplies, which is badly needed. The increase in the estimate is due to the great advance in the cost of materials and labor since the original estimate was submitted. Detailed estimate.

Alterations to present shop.....	\$5,500
New addition.....	39,500
Total.....	45,000

No. 7. *Virgin Islands, West Indies, aids to navigation.*—For establishing and improving aids to navigation in the Virgin Islands of the United States, West Indies, and adjacent waters, \$50,000.

NOTE.—The act of June 20, 1918, authorized this work, but no appropriation was made therefor. By Executive order of July 20, 1917, the lighthouse service in the Virgin Islands, West Indies, acquired by the United States by treaty from Denmark, was transferred to and placed under the jurisdiction of the United States Lighthouse Service. The aids to navigation in these islands are not extensive and will require additions and improvements to make the waters safe and to provide for increasing commerce. It is proposed to provide four unwatched gas lights, five new buoys, as well as additional aids as may be necessary after further study and developments, and to place existing lighthouse property in a good condition of repair. Detailed estimate:

4 unwatched lights.....	\$20,000
5 buoys with moorings.....	5,000
Relief and spare equipment for lights and buoys.....	5,000
Repairs to existing property.....	10,000
Additional aids to navigation, as necessary.....	10,000
Total.....	50,000

No. 8. *Staten Island Lighthouse Depot, N. Y.*—For improving and extending the wharves at the general lighthouse depot, Tompkinsville, Staten Island, N. Y., \$65,000.

NOTE.—The act of June 20, 1918, authorized this work, but no appropriation was made therefor. The wharves at the general lighthouse depot are in a very poor condition and need extensive repairs. The traffic over the wharves is heavy, and it is necessary to be continually making temporary repairs. To continue the use of the wharves by means of temporary repairs will be expensive. It is advisable to repair and rebuild the wharves as soon as practicable. The present wharf space is limited and the wharves should be extended. There are 21 vessels in the third district (7 tenders and 14 light vessels) which use the general depot wharves, besides a considerable use by vessels of the Navy Department and commercial ships. Detailed estimate:

New wharf.....	\$65,000
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31. Great Beds, N. J.....	\$13, 125
32. Conimicut, R. I.....	3, 775
33. Pecks Ledge, Conn.....	8, 125
34. Cocksackie, N. Y.....	2, 000
35. Hudson City, N. Y.....	2, 000
36. Bridgeport Harbor, Conn.....	5, 925
37. Stepping Stones, N. Y.....	3, 150
38. Mussel Bed Shoals, R. I.....	1, 975
39. Tarrytown, N. Y.....	1, 925
Miscellaneous.....	225
Grand total.....	284, 000

No. 12. *Charleston, S. C., Lighthouse Depot.*—For completing the lighthouse depot at Charleston, S. C., and constructing an administration building for the sixth lighthouse district, \$115,000.

NOTE.—The act of October 22, 1913 (38 Stat., 244), appropriated \$125,000 toward the purchase of a site and construction of a wharf and buildings and equipment, so far as funds might permit for a depot for the sixth district. This entire appropriation has been expended, but all the necessary facilities have not been provided. The site itself cost \$60,000 and the wharf \$46,418. Further requirements to complete the depot include dwellings for keeper and assistant keeper, who are required to live on the reservation, additional filling, water and sewer systems, walks, roads, oil house, blacksmith shop, additional equipment, etc. Without the completion of this project the district organization is inadequately equipped to efficiently perform its duties.

An office or administration building is needed at the site of the new depot, where necessary land is available. The sixth district office now occupies the "Old Exchange" building in Charleston, which, pursuant to act of Congress approved March 4, 1913 (37 Stat., 889), was on April 20, 1917, deeded by the Secretary of the Treasury to the Order of the Daughters of the American Revolution. The Government does not, therefore, own the building, but it is being occupied by the inspector's office under authority of the statute cited, providing for such occupancy until other suitable quarters are provided. More than half of the building has been vacated by the Lighthouse Service, and it is essential that other suitable quarters be provided for proper administration work of the district.

The logical location for such a building is at the depot site, which is the center of district activities. Detailed estimate:

Administration building.....	\$54, 000
Two keepers' dwellings.....	12, 000
Oil house.....	7, 800
Blacksmith shop.....	2, 700
Concrete-buoy storage.....	5, 600
Walks, roads, grading, water and sewer system, etc.....	17, 300
Equipment and fire protection.....	15, 600
Total.....	115, 000

No. 13. *Depot for seventh lighthouse district.*—Purchasing site for and constructing and equipping a lighthouse depot for the seventh lighthouse district, \$200,000.

NOTE.—The Lighthouse Service storehouse, wooden smithy, and wharf are on property belonging to the Treasury Department. The wooden storehouse and wharf, which are highly inflammable, are located between the Navy coal sheds and piers A and B, one of each on each side and are, therefore, in an unusually dirty location. The coal dust is practically always in motion, and when the coal conveyors are in operation it blows about in clouds. It finds its way into the depot keeper's quarters and into the storehouse, where thousands of dollars' worth of property is stored, which it is impossible to keep clean. These coal sheds have been erected since the storehouse was built. Furthermore, there are frequently several Navy torpedo-boat destroyers lying alongside at the Navy piers on each side of the depot wharf, which in addition to causing a great deal of dirt are a menace to the lighthouse tenders on account of collision. A new site and wharf are now urgently needed for the efficient and economical work of the district. Detailed estimate:

Purchase of water-front property.....	\$100, 000
Construction of wharf, including track.....	24, 000
Bulkheading.....	10, 000
Water mains.....	350
Service building, keeper's dwelling, storehouse, oil house, machine shop, carpenter shop, and blacksmith shop.....	59, 060
Boundary fence, buoy skids, and chain platform.....	3, 104
Shop equipment.....	3, 486
Total.....	200, 000

No. 14. *Aids to navigation, Alaska.*—For establishing new aids to navigation and for improvements to existing aids, in Alaska, \$75,000.

NOTE.—The appropriation of \$60,000 made by the act of June 12, 1917, for this purpose has practically all been obligated, and it is expected that projects to which the funds are applicable will be completed by the end of the present calendar year. There is a demand from maritime interests for the further establishment of new aids to facilitate and safeguard water transportation in Alaska, where navigation is unusually difficult and hazardous, as shown by the frequency of marine disasters occurring in these waters. A number of unwatched lights on shore or reefs and on buoys are needed to mark the principal routes of navigation through inside passages. A few such lights are needed to mark headlands on the outside coast for the benefit of coasting traffic, and there are a number of requests for lights to mark the entrance to harbors where fish packing or other plants are located. The fishing industry in Alaska is now being greatly expanded, and many new plants are being constructed in localities not heretofore visited by large steamers. This fact has given rise to a greatly increased demand for new aids. Estimate of cost:

2 gas buoys, at \$7,000.....	\$14, 000
3 gas buoys, at \$5,000.....	15, 000
2 acetylene lights on steel towers, at \$3,600.....	7, 200

3 acetylene lights on wooden houses, at \$3,000.....	\$9,000
4 acetylene lights on wooden houses, at \$2,100.....	8,400
8 acetylene lights on wooden houses, at \$1,200.....	9,600
6 acetylene lights on wooden houses, at \$800.....	4,800
Miscellaneous minor aids.....	7,000
Total.....	75,000

No. 15. *Ludington, Mich., aids to navigation.*—Improving aids to navigation and establishing new aids at Ludington, Mich., \$50,000.

NOTE.—The present location of the fog-signal station on the end of south pier subjects vessels to danger of striking the breakwater. The commerce of Ludington, which includes important car-ferry lines across Lake Michigan, is as important as any other port on the east shore of Lake Michigan, and as this port is most inadequately lighted now this improvement is considered well warranted. It is proposed to establish a main light on the outer end of the north breakwater, with fog-signal apparatus, consisting of electrically driven air compressor and compressed-air fog signal with oil engine reserve drive, and to discontinue the present steam fog signal in old wooden structure. Quarters for keepers should be erected adjacent to the light, as it is unsafe to cross the harbor during the winter when the ice is broken up by car ferries. Detailed estimate:

Foundation and tower.....	\$7,600
Fog-signal building.....	6,300
Illuminating apparatus.....	2,500
Fog-signal apparatus.....	7,600
Quarters for three keepers, including site.....	22,500
Minor lights on north and south pierheads.....	3,500
Total.....	50,000

No. 16. *Tampa Bay, Fla., aids to navigation.*—Establishing and improving aids to navigation in Tampa Bay, Fla., \$17,500.

NOTE.—Tampa is an important seaport with a large and growing commerce by sea. Owing to shallow water in Tampa Bay, deep-draft vessels can reach the city from the Gulf only by means of several comparatively narrow dredged cuts. Provision has already been made for lighting all of the important cuts excepting Cut D, for which lights should be provided as soon as practicable, as large vessels must pass through this cut in order to reach Port Tampa. Detailed estimate:

Concrete foundation.....	\$1,900
Metal-work towers.....	9,800
Illuminating apparatus.....	5,800
Total.....	17,500

No. 17. *Delaware Bay Entrance, aids to navigation.*—Improving the aids to navigation at the entrance to Delaware Bay, \$148,500.

NOTE.—In consequence of the continued erosion of the shore line in the vicinity of Cape Henlopen Light, Del., the early destruction of that light is anticipated, measures taken for the preservation of the shore line having proved unavailing. Every purpose now served by Cape Henlopen Light would be better served by the rebuilding of Harbor of Refuge Light to a height of about 140 feet. The establishment of large gas buoys is also required, one midway between, and in the line connecting Five Fathom Bank Light Vessel and Overfalls Light Vessel, one at the extreme lower and outer end of Hen and Chickens Shoal, and one in approximately the present position of Fifteen Foot Shoal Buoy. With the improvements recommended herein, including a red sector in the new Harbor of Refuge Light to cover Brown Shoal, the ultimate fate of Cape Henlopen Light will have no bearing on the practical needs of navigation in this vicinity. Detailed estimate:

Rebuilding Harbor of Refuge Light Station.....	\$127,800
3 gas and bell buoys on station.....	12,000
1 relief gas and bell buoy.....	4,000
2 extra gas tanks.....	1,200
2 extra buoy lanterns.....	2,000
Sinkers and moorings for buoys.....	1,500
Total.....	148,500

No. 18. *Goose Island Flats, N. J., Light Station.*—Establishing a light and fog signal at or near Goose Island Flats, N. J., \$140,000.

NOTE.—Vessels navigating the Delaware River are obliged to make a decided turn at this point. A temporary structure, protected by riprap, was carried away by the ice in January, 1910, although the riprap is partially in place and forms a menace to navigation unless properly marked. A buoy is now maintained at this location, but in winter it is impossible to keep it in position on account of the heavy ice. It is proposed to erect a light and fog signal, on a suitable heavy caisson foundation, close to the channel on the easterly side. Detailed estimate:

Foundation in place.....	\$65,000
Riprap protection for foundation.....	15,750
Erection of superstructure.....	48,750
Illuminating apparatus.....	3,600
Fog-signal apparatus.....	6,900
Total.....	140,000

No. 19. *California and Nevada aids to navigation.*—Establishing aids to navigation, California and Nevada, \$37,775.

NOTE.—Petitions have been received from numerous individuals, merchants, and owners and operators of barges and tugs for lighting the channel between Point San Mateo and the mouth of Alviso Slough. This waterway is the natural outlet for nearly all the produce of the extensive Santa Clara Valley, and the

annual traffic, which is now reported to be upward of 50,000 tons, will be greatly increased if the channel is properly marked. The deep channel is narrow and winding, and at present there are no aids to assist mariners in keeping off the shoals at night. Much of the traffic must be carried on at night to take advantage of the tides. A petition to the Secretary of Commerce, dated November 16, 1916, asks for various lighted aids in this locality, which are urgently needed and should be established at once. Gas buoys should also be provided at Fort Rose and Point Buchan. The act of August 28, 1916 (39 Stat., 538), authorized aids to navigation on Lake Tahoe, Cal. and Nev., but no appropriation was made therefor, and funds have not been available from the general appropriations of the Lighthouse Service. Lake Tahoe has an area of approximately 200 square miles, is 21 miles long, has a mail route 70 miles long, and a great many passengers are carried on numerous steamers and launches there annually. Detailed estimate:

3 type "L" acetylene buoys, at \$3,000.....	\$9,000
2 type BW 600-II acetylene buoys, at \$5,000.....	10,000
1 type "O" acetylene buoy.....	4,000
7 type "S" acetylene buoys, at \$1,200.....	8,400
Establishing 6 minor lights and 5 day marks.....	4,867
Illuminating apparatus.....	1,708
Total.....	37,775

No. 20. *Depot keepers' dwellings.*—For the construction of two dwellings at the Goat Island Lighthouse Depot, \$16,500.

The present quarters at the Goat Island Lighthouse Depot, consisting of two old frame dwellings located just above high water, are poorly arranged, insanitary on account of their locations, and wholly inadequate to accommodate the depot force. Two families at present occupy one cottage of seven rooms and three families occupy another cottage of eight rooms. There are no quarters available for the assistant depot keeper or the mechanic, both of whom are required to make long journeys to and from San Francisco each day. On account of the position of Goat Island in the middle of San Francisco Bay with no ferry service except the irregular one provided by the naval training station on the island, it is essential that the depot keepers and the mechanic, all of whom are in charge of important work at the depot, should be quartered there in order to properly carry on their work. Two dwellings are required to be built on the higher ground adjacent to the depot for the accommodation of the keeper and the mechanic in charge of the depot shops. Estimate of cost:

Two dwellings, hollow-tile construction..... \$16,500

Total group No. 1, authorized by law, \$1,653,500; not yet authorized, \$1,084,275.
Total, \$2,737,775.

GROUP NO. 2.

Works considered essential for the needs of navigation and the equipment of the Lighthouse Service, and which it is recommended be undertaken as resources permit, are submitted with estimates of cost. (These items have been selected from a much larger number of recommendations submitted by the superintendent of the lighthouse districts and others.)

No. 21. *Point Pinos, Cal., Light Station.*—For improving Point Pinos Light Station, Cal., \$37,500.

NOTE.—Improvements to the combined tower and dwelling at this station are required to keep them in a serviceable condition. Fogs are of frequent occurrence at this point, and a first-class compressed-air signal, together with quarters for two additional keepers, are urgently required. Traffic into Monterey Harbor is steadily increasing and a number of large oil-carrying steamers now run regularly to this port where oil is piped from the oil fields in the interior of the State. Numerous requests have been received from shipping interests to establish a first-class fog signal at this point. The Union Oil Co. has lost one steamer at the entrance to this harbor. There is an average of 800 hours of fog per annum at this station. Detailed estimate:

Fog-signal building.....	\$4,500
Fog-signal apparatus.....	11,500
Dwelling for two keepers.....	16,000
Improvements to present station.....	5,500
Total.....	37,500

No. 22. *Michigan Island, Wis., Light Station.*—For establishing and improving aids to navigation at or near Michigan Island, Lake Superior, Wis., \$85,000.

NOTE.—The act approved May 27, 1908 (35 Stat., 332), appropriated \$2,000 to make a survey and estimate of cost and report upon the feasibility and need of establishing a light and fog signal upon Gull Island or the easterly end of Michigan Island, Apostle Group. As a result of this survey, the conclusion has been reached that the eastern end of Michigan Island is the better site. The act of June 17, 1910 (36 Stat., 536), authorized the construction of a light and fog-signal station at Michigan and Gull Islands at a cost not to exceed \$140,000, but no appropriation has been made therefor. A further study indicates that the best plan is to elevate the present light near the westerly end of Michigan Island, add a fog signal, and establish a nonattended acetylene light on Gull Island. This arrangement would serve as a better guide to vessels passing in either direction. The project now contemplated will not cost as much as the amount authorized. Detailed estimate:

Foundation, main light.....	\$3,000
Dwellings for three keepers.....	20,000
Tower complete (erection only).....	6,000
Minor light.....	9,495
Illuminating apparatus.....	10,000
Fog signal and hoisting apparatus.....	13,550
Fog-signal building, boathouse, and other buildings.....	13,455
Boats, tramway, walks, etc.....	9,500
Total.....	85,000

No. 23. *Kauhola Point, Hawaii, Light Station.*—For improving the light station at Kauhola Point, Hawaii, \$20,000.

NOTE.—Owing to the importance of this station, located near the northern point of the Island of Hawaii, steps have been taken to change the present lens-lantern light to a converted flashing fourth-order lens. To support this lantern and lens and to complete the improvement of this station, a new tower is necessary. A dwelling for the assistant keeper should also be provided. Detailed estimate:

75-foot cast-iron tower in place.....	\$14,750
Foundation for piers for tower.....	1,000
Dwelling.....	4,000
Improvement to grounds.....	250
Total.....	20,000

No. 24. *Anacapa Island, Cal., Light Station.*—For establishing a light and fog signal at or near Anacapa Island, Cal., \$115,000.

NOTE.—Practically all coastwise vessels and a large number of those bound for Panama use the Santa Barbara Channel. The desirable course leads close to the eastern end of Anacapa Island, which is now marked by a small beacon light, not sufficiently powerful to be of service in hazy weather. The American Shipmaster's Association has presented a petition for a light and fog signal, indorsed by the San Francisco and Los Angeles chambers of commerce and important shipping interests on the Pacific coast. It is therefore recommended that a light of high candlepower and a first-class fog signal be established at this point as soon as practicable. Detailed estimate:

Light tower.....	\$16,800
Illuminating apparatus.....	6,800
Fog-signal building and apparatus.....	18,100
Two sets double quarters for four keepers.....	33,000
Oil house, outbuildings, etc.....	7,700
Wharf, launch landing, and derrick.....	9,600
Roads, grading, and fencing.....	6,000
Water supply and sewerage system.....	13,000
Launch and station boats.....	4,000
Total.....	115,000

No. 25. *Santa Barbara, Cal., Light Station.*—For improving Santa Barbara Light Station, Cal., \$33,000.

NOTE.—The station is old and the tower is too small to accommodate the revolving lens now installed in it. The tower stands one-eighth of a mile back from the point of the shore line and the light is partly obscured by trees on other properties. A new tower is required to be built farther out on the point. Coastwise vessels bound north keep close inshore to avoid the prevailing northwesterly winds and sea, and a fog signal should be established here with quarters for two additional keepers. An improvement has been made in changing the light from fixed to flashing and an increase of intensity. The fog signal as well as other improvements, and a new light tower, are necessary to render the aids efficient. Detailed estimate:

Tower, lantern, and fog-signal building.....	\$10,000
Fog-signal apparatus.....	11,500
Additional quarters.....	8,400
Improvements to present station.....	3,100
Total.....	33,000

No. 26. *Cape Spencer, Alaska, Light Station.*—For establishing a light and fog-signal station at or near Cape Spencer, Alaska, \$145,000.

NOTE.—Cape Spencer is at the entrance to Cross Sound and Icy Strait, through which pass all vessels running from Puget Sound ports to Prince William Sound, Seward, Cook Inlet, and Kodiak, excepting only occasional freighters proceeding by the outside route. With the construction of the proposed Alaskan railroad the traffic by way of Cape Spencer will be materially increased. A small unwatched light is now maintained on the cape, but it is believed that a large watched light and fog signal should be provided, especially for vessels returning from the westward, to be used as a landfall, as it is important that they be given all possible assistance, especially in thick weather. Maritime interests have urged the establishment of this aid. Detailed estimate:

Transportation and housing of materials and men.....	\$26,000
Main station structure.....	71,500
Tower superstructure and metal work.....	17,500
Minor structures.....	10,400
Illuminating apparatus.....	10,600
Fog-signal apparatus.....	9,000
Total.....	145,000

No. 27. *Staten Island, N. Y., Lighthouse Depot.*—For construction and equipping a floating dry dock at the general lighthouse depot, Tompkinsville, Staten Island, N. Y., \$200,000.

NOTE.—Owing to the great number of vessels in the third lighthouse district (7 tenders and 14 light vessels) and vessels from other districts that come to the general depot for repairs, a dock of this kind is urgently needed and will result in a great saving to the Government. In the present conditions of ship-building and repair work it is very difficult to have repairs to lighthouse vessels done at all. Detailed estimate:

2,000 tons capacity dry dock.....	\$200,000
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No. 28. *Portage Lake, Mich., aids to navigation.*—For establishing a light and fog-signal station upon a new site and improving aids to navigation at Portage Lake Ship Canals, Mich., \$100,000.

NOTE.—The War Department intends to remove the breakwater, and it is therefore necessary to rebuild the light and fog signal on a new site. The new light and fog signal should be established on a pier at the outer entrance, where it would be of the best service to vessels making the harbor. The construction of the station proposed will require considerable time to complete, and this project should have consideration for that reason. The harbor pier on which the present pierhead light station and fog-signal house stand, as well as the timber superstructure under the fog-signal house, are rapidly deteriorating, and it is doubtful if these structures can be maintained much longer in a safe condition unless extensive repairs are made to their foundations, which would be unnecessary in the event of the establishment of the proposed new station. Detailed estimate:

Foundation and concrete base of tower.....	\$64, 000
Superstructure.....	22, 500
Fog signal and lighting equipment.....	13, 500
Total.....	100, 000

No. 29. *Ram Island, Me., Light.*—For establishing a light on Ram Island, lower Kennebec River, Me., \$5,400.

NOTE.—The need of this light has several times been expressed by petition. Ram Island is about 5½ miles below Bath, Me.; it is a low island in the middle of the river, with a string of half-tide ledges making off on the easterly side. There is a passage on either side, and at some stages of the tide a 5-knot current exists, from which several accidents have occurred. About 420,000 tons of freight and 175,000 passengers are transported past this island annually, not including the many pleasure craft and small boats which frequent the river. It is proposed to establish an acetylene light on or near the easterly side of Ram Island. Detailed estimate:

Light structure, including site.....	\$3, 050
Illuminating apparatus and installation.....	1, 950
Contingencies.....	400
Total.....	5, 400

No. 30. *Cape Kumukahi, Hawaii, Light.*—For establishing a light at or near Cape Kumukahi, Hawaii, \$22,000.

NOTE.—Cape Kumukahi is the easternmost cape of Hawaii. There is at present no landfall light for vessels bound to Hilo from the Panama Canal or from the southeast. It is a difficult point to round when sailing from Hilo to the south point or vice versa. A light on this point would be a great improvement to the lighting of the islands. The country in this vicinity is barren, undulating lava rock. An acetylene light is recommended, with a focal-plane height of about 150 feet, which would be visible about 20 miles. Landing from seaward at the cape is impossible at most times, and the only practical method of supplying this station would be by railroad from Hilo to Kapoho and then by wagon road 3 miles to the cape, 1½ miles of which would have to be constructed over the rock. Detailed estimate:

Station site and right of way for road.....	\$500
Concrete foundation for tower.....	740
Superstructure, tower.....	9, 000
Illuminating apparatus.....	4, 640
Roadway, construction of.....	7, 120
Total.....	22, 000

No. 31. *Henderson Point, Me., Light Station.*—For establishing a light and fog signal at or near Henderson Point, Piscataqua River, Portsmouth Harbor, Me., \$7,500.

NOTE.—The need of this aid has several times been expressed by petition. It is often very difficult to locate Henderson Point at night and in thick weather; the channel is narrow and there is a strong tide at this point, where the course changes. The commercial statistics for Portsmouth Harbor indicate about 5,600 vessels arriving and departing annually, transporting about 610,000 tons of freight. It is proposed to establish an acetylene light with fog bell. Detailed estimate:

Structure, including site.....	\$3, 350
Illuminating and fog-signal apparatus.....	3, 750
Contingencies.....	400
Total.....	7, 500

No. 32. *Port Real, P. R., or East Point Vieques Island, Light Station.*—For establishing a light station at or near Port Real, P. R., or East Point Vieques Island, \$40,000.

NOTE.—The lighthouse at Port Ferro, on the south coast of Vieques, or Crab Island, is one of the primary seacoast lights of the Porto Rican system. The light tower and the keepers' dwelling attached to it are built on top of a rocky promontory undermined for some time by the sea, and the whole structure, already dangerously cracked, is in danger of collapsing. It is urgent to rebuild a lighthouse at or near this point, as this is an important aid to the navigation from St. Thomas to Cuba and other West Indian Islands and the Caribbean Sea. A light in this vicinity is necessary for navigation, and it is proposed to dismantle the present Port Ferro Light Station and to erect a new light station at Port Real, about 3 miles westward, where the aid will be more useful and on better ground than on its present location at Port Ferro, as Port Real is the most important and the best anchorage around Vieques Island. The present apparatus at Port Ferro is to be used for this new station. Detailed estimate:

Tower and dwellings for two keepers.....	\$25, 000
Outbuildings and fence.....	1, 000
Purchase of site.....	2, 000
Grading and walks.....	1, 000
Installation of illuminating apparatus.....	1, 000

Metal work.....	\$8,000
Woodwork.....	2,000
Total.....	40,000

No. 33. *Nine Mile Point, Mich., Light Station.*—For establishing a light and fog-signal station at or near Nine Mile Point, Mich., \$50,000.

NOTE.—When Forty Mile Point Light Station was established it was placed on the site designated Forty Mile Point on the county-survey charts. Sailing masters expected the station to be placed at Nine Mile Point, near the entrance to the Straits of Mackinac, but which was not so called officially then. While Nine Mile Point is within the visibility of Spectacle Reef and Poe Reef Light Vessel lights, a fog signal would be of especially great service in thick and foggy weather and during seasons when forest fires prevail. Not less than nine strandings occurred here between 1903 and 1909. In the event of establishing this station, Forty Mile Point could be made a minor light. Detailed estimate:

Tower and fog-signal building, including site.....	\$26,100
Illuminating apparatus.....	5,500
Fog-signal apparatus.....	2,000
Dwellings for three keepers.....	12,000
Outbuildings, boathouse, fences, etc.....	2,600
Boats and equipment.....	1,800
Total.....	50,000

No. 34. *Caribbean Sea, aids to navigation.*—For establishing aids to navigation in the Caribbean Sea along routes leading to the Panama Canal, \$75,000.^a

NOTE.—The need for aids to navigation in the Caribbean Sea has become more urgent with the increase of traffic due to the Panama Canal, and such aids have been requested by the steamship companies using these routes. It is proposed to establish gas and whistling buoys at Farrall Rock (Gorda Bank), Southwest Cay (Serrana Bank), Formigas Bank, and Blower Rock (Pedro Bank), and unwatched acetylene light on the south end of Old Providence Island, another unwatched light at Courtown Cays and a first-class can buoy to mark the north end shoal of Old Providence Island. Detailed estimate:

4 gas and whistling buoys with moorings, etc., on station.....	\$26,000
2 gas and whistling buoys with moorings, etc., relief.....	13,000
1 first-class can tall-type buoy.....	1,000
2 towers in place.....	30,000
Illuminating apparatus.....	5,000
Total.....	75,000

No. 35. *Galveston Jetty Light Station, Tex.*—For improving Galveston Jetty Light Station, Tex., \$8,500.

NOTE.—The appropriation for this station is insufficient for the purchase and installation of a sufficiently powerful fog signal. It is recommended that a compressed-air fog signal be installed as soon as funds permit. Detailed estimate:

Compressors.....	\$5,000
Fog-signal apparatus.....	2,000
Piping and installation.....	1,500
Total.....	8,500

No. 36. *Grays Harbor Light Station, Wash.*—For improving Grays Harbor Light Station, Wash., \$15,000.

NOTE.—The present steam fog-signal plant at this station is located in a frame building. Both the machinery and building are quite old and in poor condition. It is proposed to construct a new fireproof building and install an electrically operated siren as soon as funds permit. Detailed estimate:

Fog-signal building.....	\$6,500
Purchase and installation of apparatus.....	8,500
Total.....	15,000

No. 37. *Lighthouse depot in vicinity of Newport, R. I.*—For purchasing site and building wharf and storehouse for new lighthouse depot in Narragansett Bay, same to be located at Newport, R. I., or vicinity, \$82,300.

NOTE.—The present depot is located on the breakwater at Newport Harbor, this location being very unsatisfactory and inconvenient, as the water at the dock is too shoal for the larger tenders, and there are no facilities for tenders getting water, or having provisions, etc., delivered, which necessitates the tenders going to Newport for provisions, etc., causing much waste time during working hours. The Navy Department is building along the breakwater continuously and the present plans of the Navy bring them down to the lighthouse depot. The present dock is in very bad condition, due to age, decay, and worming of piles, and at present is unsafe for further use. Improvement of the depot on the existing site is not considered economical, owing to lack of space and other conditions. Detailed estimate:

Purchase property for new depot.....	\$40,000
Building new wharf.....	37,800
Building new storehouse.....	4,500
Total.....	82,300

^a Upon the recommendation of the Secretary of Commerce an allotment of \$100,000 has been made by the President from the appropriation for national security and defense for the project covered by Item No. 34.

No. 38. *Lake Champlain, N. Y.*—To establish acetylene lights, build and equip a gasolene tender, and rebuild Juniper Island Light Station wharf to accommodate the tender on Lake Champlain, \$150,000.

NOTE.—In the interest of efficiency and economy it is proposed to discontinue all oil lights on Lake Champlain except at stations where there is a fog bell, and establish acetylene lights in their places. The motor-driven tender will remain constantly on the lake to care for the operation and repair of the light stations. This change from oil to acetylene will result in considerable saving. It will permit better care and maintenance of the aids to navigation on Lake Champlain and relieve the tender *Daisy* from this work, thus enabling her to do more work in the vicinity of New York Bay, where her services are much needed. Detailed estimate:

8 large lights.....	\$25,000
21 small lights.....	55,000
Gasolene tender.....	25,000
Rebuilding wharf at Juniper Island Light Station, with storeroom, gas-tank house, and ways for taking tender out of water in winter.....	45,000
Total.....	150,000

No. 39. *Sag Harbor, N. Y.*—For establishing five acetylene lights in the channel leading into and in the vicinity of Sag Harbor, N. Y., and improving illuminating apparatus at Sag Harbor Breakwater and Cedar Island Light Stations, \$45,700.

NOTE.—This channel is crooked, narrow, and rocky, and a system of acetylene flashing lights is much needed. It is proposed to place the lights on steel towers having concrete and riprap foundations. Detailed estimate:

5 acetylene lights complete.....	\$30,600
Improving illuminating apparatus, Sag Harbor Breakwater Light.....	6,100
Improving illuminating apparatus, Cedar Island Light.....	9,000
Total.....	45,700

No. 40. *Manitowoc, Wis.*—For improving aids to navigation and building keepers' dwellings, \$16,000.

NOTE.—The aids to navigation at this station are now being improved by the construction of a steel fog-signal house and light structure and the installation of an improved light and fog signal, under an appropriation of \$21,000, made by act of June 12, 1917.

The keeper's present dwelling is an old house and will constantly necessitate the expenditure of considerable amounts for repairs and upkeep. It is badly located with reference to the lights in charge of the keepers. The dwelling should be located near the inner end of the breakwater, overlooking the harbor. Detailed estimate:

Dwelling:	
Site.....	\$500
Brick or tile dwelling.....	13,500
Necessary outbuildings, fences, walks, grading.....	2,000
Total.....	16,000

No. 41. *Repairs and improvements, light stations, Alaska.*—For repairs and improvements to existing aids to Alaska, \$70,000.

NOTE.—Owing to the increasing volume and importance of the commerce of Alaska, it is very desirable that important improvements be made in certain lights and fog signals, as urged by mariners. Also, it is necessary to replace some worn-out station equipment, and at some stations improvements are needed for the betterment of protection of the station. At Guard Island, an important station at the westerly end of Tongass Narrows, it is desired to replace the present unsatisfactory fog bell with an air diaphone and to construct a suitable permanent light and fog-signal building to replace present temporary wooden tower; also to erect another dwelling in order that two keepers may be assigned instead of one as at present, and thus provide for continuous night and day watches. At Point Retreat, an important station, there is now only an unwatched acetylene light and no fog signal. All regular vessels plying between southeastern and southwestern Alaska pass this point, either by way of Favorite Channel or by way of Lynn Canal and Skagway. It is proposed to establish an air diaphone fog signal and assign keepers, a suitable permanent structure to be erected for the light and fog signal, and unused dwelling now at the station to be repaired and refurnished for the use of the keepers. At Scotch Cap it is proposed to install a flashing lens in place of present fixed lens, which will increase the power of the light and render it distinctive from other fixed lights. This is an important coast station located on Unimak Pass and is made by all vessels passing from the Pacific Ocean to Bering Sea. Shore protection is also needed at this station, as the dwellings are threatened by encroachment of the sea, and new machinery is needed to replace that worn out in service. At Tree Point Light Station present water supply is subject to interruption through freezing and is not considered healthful. It is proposed to lay a pipe line to a lake about 1 mile distant. Mariners have complained that the air siren fog signal at Cape Hinchinbrook Light Station is not effective, and it is desired to replace same with an air diaphone. This is a very important station situated at the entrance to Prince William Sound. Detailed estimate:

Guard Island Light Station.—Install diaphone, construct light and fog-signal building, erect dwelling, etc.....	\$28,000
Point Retreat Light.—Install diaphone, construct light and fog-signal building, repair dwelling, etc.....	27,000
Scotch Cap Light Station.—Purchase new compressors and engines, install flashing lens in place of fixed lens, construct shore protection.....	9,500
Tree Point Light Station.—Construct pipe line from lake to station.....	1,530
Cape Hinchinbrook Light Station.—Install diaphone in place of present siren.....	1,400
Contingencies, repairs, and improvements.....	2,570
Total.....	70,000

Total, group No. 2, \$1,322,900 (not included in total of estimates).

DESCRIPTIONS OF NEW WORKS COMPLETED.

The following are brief technical descriptions of important lighthouse works completed since the end of the fiscal year 1917:

AIDS TO NAVIGATION, CAPE COD CANAL, MASS.

Purpose.—On completion of the Cape Cod Canal, the dredged channel in Buzzards Bay leading to same, and the breakwater at the eastern Sandwich entrance, it became necessary to light these two entrances and also increase the intensity of the light and power of the fog signal at the Wings Neck Light Station.

Sites.—Canal Breakwater Light is located near the outer end of Cape Cod Canal Breakwater, Sandwich, Mass., about 2,000 feet from shore, and is supplied with electric current for operating the light through an armored lead-sheath submarine cable leading to shore.

Lighted beacons Nos. 5, 5A, 6, 6A, 7, 8, 9, 10, 11, 12, 13, 14, 15, and 17 were located along the dredged channel in Buzzards Bay leading to the westerly entrance to Cape Cod Canal, to mark its boundaries.

Wings Neck Light Station is located in Buzzards Bay, on the north side of entrance to dredged channel leading to Cape Cod Canal.

Structures.—Canal Breakwater: The foundation is a reinforced concrete slab 10 feet by 10 feet by 2 feet, located on top of breakwater. The slab supports a 30-foot steel skeleton tower and a meter house built on top of same.

Canal dolphin lights Nos. 5, 5A, 6, 6A, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, and 17 each consists of five creosoted white oak piles driven about 20 feet into the bottom, four of them in the form of a square 15 feet on a side, with the fifth pile in the center. The tops of the four outside piles were drawn into and bolted to the center pile, the whole then being bound together by three turns of one-half inch galvanized chain, securely spiked in place. The tops of the dolphins are surmounted each by a 7-foot by 7-foot wooden platform with railing and ladder and a wooden tank house 4 feet 6 inches by 4 feet 6 inches in place.

The acetylene lanterns surmount the tank houses.

Wings Neck fog-signal house is of brick, laid in cement mortar, concrete foundation and floors, and slate roof. Two cooling water cisterns are located beneath the floor at each end of the building.

Illuminating apparatus.—Canal Breakwater: The illuminating apparatus consists of a 300-millimeter lens lantern showing a fixed white light of 2,500 candlepower. The focal plane is about 40 feet above high water, and the light is visible 12 miles in clear weather. The light is furnished by a 250-watt concentrated filament mazda electric lamp, controlled from a transformer house at the shore end of the cable. The current is supplied by local electric light company from their 2,300-volt line, and is stepped down to 110 volts by a transformer.

Canal dolphin lights: The illuminating apparatus of the 14 lights consists each of a 200-millimeter acetylene lantern, showing flashing lights of the proper color to mark their respective sides of the channel, the red lights being 20 candlepower and the white lights 70. Their focal planes are each about 22 feet above high water. The light to each of these lanterns is furnished by a one-half foot burner using compressed acetylene gas, controlled by flashing mechanism.

Wings Neck: The illuminating apparatus consists of a fourth-order fixed lens showing a fixed white light of 2,900 candlepower. The light is furnished by a 35-millimeter type B vapor oil lamp.

Fog signal.—Wings Neck: The fog signal consists of a first-class reed horn operated by air compressed to 6½ pounds. The characteristic is a blast of 2 seconds duration followed by a silent interval of 18 seconds. The valve to horn is operated by automatic clocks in duplicate. The copper horn projects through the side gable of signal house and is about 25 feet above high water. The two steel air tanks are located at one side of the first floor with pipes leading to valve and reed box on second floor; the compressing plant consists of 9-horsepower single-cylinder vertical Mietz & Weiss oil engines, with 7 by 8 inch vertical compressor on same shaft, running at about 300 revolutions per minute; compressing outfits are in duplicate. The cooling water to oil engines and compressors is supplied by a 2 by 1½ by 2½ inch Blake duplex pump operated from the high-pressure air tank at 25 pounds pressure. The water is pumped from one end of each cistern and returned to opposite end of same cistern.

Cost.—An act of August 1, 1914, appropriated \$50,000 for Cape Cod Canal Lights, Mass. The 16 above-mentioned lights (omitting the signal house at Wings Neck, which was built from general expenses, Lighthouse Service, 1917), together with 1 acetylene high-power gas and bell buoy, 1 Pintach gas and bell buoy, and 1 spar buoy at the western entrance, and 3 acetylene gas and bell buoys and 3 acetylene gas buoys at the Buzzards Bay entrance to dredged channel, were established at a cost of \$49,905.99.

The steel tower, steel tanks, piping, duplex pump, and air compressing outfits were purchased in the open market by informal contract; the horn, reed box, valve, and automatic clocks were obtained from the general depot at Tompkinsville, N. Y., and the field work was carried out by hired labor.

The work was started November, 1914, and completed October 1, 1917.

NAVASSA ISLAND LIGHT STATION, WEST INDIES.

Purpose.—The increase of traffic through the Windward Passage brought about by the opening of the Panama Canal made it necessary to build a light on Navassa Island, as vessels plying between Atlantic ports of the United States and the Canal Zone pass close by the island. The light went into commission October 21, 1917.

Site.—The island is located 30 miles west of Haiti, 90 miles south of Guantanamo Bay, Cuba, and is 2 miles long and 1 mile wide, of limestone rock formation, the sides rising perpendicularly from the sea to the lower level about 30 to 60 feet above the sea. From the inner edge of the lower level there is a steep slope to the upper level. The upper level is nearly flat and approximately 240 feet above the sea. The station is located on one of the highest spots in the southern part of the island, 245 feet above the water.

Structure.—The tower is built of reinforced concrete. The foundation block is 40 feet square, 6 feet deep, resting on solid rock. The shaft of the tower is cylindrical, 15 feet in diameter, with an overhanging gallery at the watch-room-floor level. Above the concrete walls of the watch room the tower is surmounted by a second order cast-iron helical bar lantern the focal plane of which is 150 feet above the grade line and 395 feet above mean high water. The third, sixth, service, and watch-room floors are of reinforced concrete. The intermediate floors consist of sectional cast-iron plates bolted to the walls of the tower. The stairs between landing are of cast iron. The cast-iron center column supporting the landings extends from the first floor to the watch room and is used as a well for the weights driving the illuminating apparatus.

Illuminating apparatus.—The illuminating apparatus consists of two fourth-order lenses, each with two 90° lens panels, mounted side by side on a revolving plate supported on ball bearings. Each lens is fitted with a 35-millimeter, type "A," incandescent oil lamp, and both lamps burn simultaneously. Two 90° spherical mirrors are placed behind each light. The lenses are mounted so that the beams from each lens coalesce at a short distance from the lantern and form a single flash. The characteristic is a double white flash every 30 seconds, each with an intensity of 47,000 candles, and is visible 27 nautical miles in clear weather. The kerosene for the lamps is stored in tanks at the foot of the tower and pumped to the service room by a self-measuring oil pump.

Quarters.—The quarters consist of a reinforced-concrete building 58 feet square, with a patio in the center. The building is a single-story structure with the roof sloping from the parapet of the outside walls toward the center, the roof being used as a collecting surface for rain water, which is caught and stored in the concrete cistern under the patio, whose storage capacity is 22,000 gallons. There are five rooms for the keeper and a storeroom on one side of the house and four rooms for each assistant on the other side. One living room in each apartment has a tile floor. The rest are concrete. The kitchens are fitted with Spanish stoves, porcelain-enamel sinks, and pitcher pumps. Each keeper has a pantry in the storeroom.

The landing is on the south side of the island at Lulu Bay. The landing is made from small boats by a hanging ladder on a ledge about 10 feet above sea level; thence by inclined concrete ramps to the lower level. A 2-ton crane of 15 feet swinging radius is installed at Lulu Bay for the purpose of taking up supplies and small boats. There is a railroad track from the landing to the light station, running first along the lower level for a distance of about 1,100 feet, then up a steep incline to the upper level, and finally along the upper level to the station a distance of about 1,200 feet. A gasoline hoisting engine is installed at the top of the steep incline for hauling supply cars from the lower level to the upper level, and a hand winch is provided near the station for hauling the cars out of the cut to the site itself.

Cost.—The station was established under the act of October 22, 1913, appropriating \$125,000 for the erection of a light station on Navassa. The amount expended to June 30, 1918, was \$116,159.40. The metal work and construction work was done by

contract. The work was commenced in January, 1916, and completed in November, 1917.

AIDS TO NAVIGATION, ASHTABULA HARBOR, OHIO.

Purpose.—For rearranging, rebuilding, and improving aids to navigation at entrance to harbor, necessitated by breakwater extensions enlarging the harbor. The principal light went into commission September 21, 1916, and its fog signal March 26, 1917. The minor light went into commission July 17, 1914.

Site.—The principal light and fog signal is located on the outer end of the west breakwater, with a minor light on the west end of breakwater opposite to it, both at the entrance to the harbor.

Structures.—The west pierhead is 40 by 60 feet in plan. The foundation timber crib filled with reinforced concrete and stone was built by the United States Engineer Department. The base of reinforced concrete was built up by the Lighthouse Service from a point 4 feet above mean lake level to an elevation of 16 feet.

The steel lighthouse structure was moved from its old location on the breakwater, a distance of about 1,800 feet, to the new pierhead, and an addition of similar construction, 20 by 24 feet in plan, one story high, built on to provide additional floor space required for the fog-signal plant. The interior of the building was reconstructed, using brick lining and plaster for the walls. The power-room floor is tile and the floors of the quarters are hardwood. A pipe railing is provided around the edge of the pier for protection. The building supports a fourth-order helical bar lantern whose focal plane is 35 feet 5 inches above the top of the pier.

The structure on the east breakwater pierhead is a standard 25-foot skeleton steel tower, resting on concrete foundation piers.

Illuminating apparatus.—The illuminating apparatus at the principal light consists of a fourth-order, 6-panel, revolving lens, mounted on a mercury float pedestal and using a type "A" 35-millimeter incandescent oil-vapor outfit. The light characteristic is a white flash every 5 seconds, with an intensity of 14,000 candles. The focal plane is 51 feet 5 inches above mean lake level and the light is visible 15 miles.

East breakwater: A 300-millimeter lens lantern is used in connection with an automatic acetylene-gas installation, the characteristic being a red flash every 3 seconds with an intensity of 80 candles. The focal plane is 37 feet above mean lake level and the light is visible 9 miles.

Fog signal.—A type "F" diaphone, using compressed air. The power plant consists of a 25-horsepower direct-connected tandem engine and compressor unit, in duplicate, operating on kerosene or power distillate. The characteristic is one blast of 2 seconds every 20 seconds.

Quarters.—There are three keepers who have quarters in the new main building while on duty with a keepers' dwelling with quarters for two families ashore. The basement of the new building contains a cellar, cistern, coal bin, storeroom, and oil and paint room. The first floor contains the engine room, a bedroom, and bathroom. The second floor a living room, pantry, a bedroom, tank room, and hallway leading to watch room above.

Cost.—The aids were established under the act of October 22, 1913, appropriating \$45,000. Total cost to June 30, 1918, \$4,429.72. The work was done by hired labor and purchase of materials.

CLEVELAND HARBOR FOG SIGNAL, OHIO.

Purpose.—On the completion of the rubble-mound breakwater arms, and the establishment of the main light on the west arm, it became necessary to remove the fog signal to the same location in order to obtain the highest efficiency and concentrate the duties of the keepers. It went into commission August 18, 1916.

Site.—The fog signal is located on the outer pierhead on the arm extending from the west breakwater, main entrance to Cleveland Harbor, Ohio.

Structure.—A rectangular steel building 29 by 31 feet in plan and 24 feet high, connected with the tower by a passageway, was built. The roof is covered with asbestos shingles and a monitor for housing the fog signal was built on the ridge near the gable.

Fog signal.—The apparatus consists of a type "F" diaphone, using compressed air. The power plant consists of a 25-horsepower direct-connected tandem engine and compressor unit, in duplicate, operating on kerosene or power distillate. The characteristic consists of 2 blasts every 30 seconds.

Cost.—The fog signal was removed, reconstructed, and improved under the act of October 22, 1913, appropriating \$17,600 for the work. Amount expended to June 30, 1918, \$17,312.82. The metal work for the building was made under formal contract. Construction was made by hired labor and purchase of materials.

AIDS TO NAVIGATION, TOLEDO HARBOR, OHIO.

Purpose.—To increase the efficiency of Manhattan Range Lights marking the straight channel in Maumee Bay, which were too low and frequently obscured by smoke and vessels mooring in the lagoon. They were raised and lights reestablished May 24 and 25, 1918.

Sites.—The ranges are located on the north side of the entrance into the Maumee River from the bay, Toledo, Ohio. The front light is on an artificial island. The rear light is about two-thirds of a mile southwest from the front light on the bank of the river.

Structures.—The new structure replacing the old frame ones is a steel skeleton tower, square, pyramidal in shape. The focal plane of the front light is 33 feet 9 inches and of the rear 76 feet above the top of the foundation.

Illuminating apparatus.—The range lenses formerly in use were installed in the new towers. The illuminant is electricity, 75-watt concentrated filament lamps being used. The lights are operated on 32-volt current, and the installation is so arranged that in the event of any interruption in the city current the light will operate from a set of storage batteries. The batteries have sufficient capacity to run the lights for two or three nights without recharging. The city current is taken through tungsten rectifiers, reducing the voltage from 112 volts alternating current to 32 volts direct current and connected with the lights and batteries in such a way that under normal conditions the batteries are automatically kept fully charged.

The characteristic of the lights is fixed red with a rated candlepower of 36,000 and 56,000 for the front and rear, respectively. The focal planes are 40 and 83 feet, respectively, above mean lake level, and they are visible 13 and 17 miles.

Quarters.—There is one keeper at this station with quarters in the frame dwelling constructed when the station was established in 1895.

Fog signal.—There is no fog signal.

Cost.—The work was carried out under the appropriation of \$15,000 made by the act of July 1, 1916. The amount expended to June 30, 1918, \$13,231.81. Work was done by hired labor and purchase of materials.

AIDS TO NAVIGATION, ALASKA.

Purpose.—To meet the demands of the increasing commerce and to continue the work of establishing efficient aids to navigation, 6 acetylene lights, 1 gas buoy, and 1 oil post lantern were established at various points in Alaskan waters during the fiscal year ending June 30, 1918. Data relative to these aids are shown in the table following.

Quarters.—No quarters were provided. All acetylene lights are of unwatched type, using compressed acetylene in acetone, supplied from batteries of steel cylinders which contain a sufficient supply of gas to operate the light continuously between visits of the lighthouse tenders.

The oil post lantern is cared for by a keeper who receives \$10 per month for his services.

Cost.—The balance from the appropriations of August 1, 1914, and \$49,469.07 from the appropriation of June 12, 1917, was expended during fiscal year 1918.

Name of light.	Locality.	Structure.	Top of lantern above ground, in feet.	Illuminating apparatus.	Characteristic.	Intensity of light, in candles.	Focal plane above mean high water, in feet.	Miles approx. seen.	Approximate cost.	Date of establishment.
Black Rock.....	Revillagigedo Channel.	Gray cylindrical house on pyramidal skeleton structure.	29	Acetylenelens lantern.	Flashing white (flash 0.3, eclipse 2.7 sec.).	130	42	9	\$2,926	Mar. 15, 1918
Helm Rock Gas and Bell Buoy. ^a	Sumner Strait.....	Type L gas buoy.....	.....	.....do.....	Flashing white (flash 0.2 sec., eclipse 1.8 sec.).	130	12	8	1,727	Jan. 16, 1918
Kalgin Island.....	Cook Inlet.....	White wooden house..	10	.....do.....	Flashing white (flash 0.3 sec., eclipse 2.7 sec.).	130	30	9	2,755	Aug. 22, 1917
Klawak Island.....	San Alberto Bay.....	Red pyramidal wooden tower, upper part slatted.	28	Post lantern, oil.....	Fixed red.....	20	14	4	132	Apr. 1, 1918
Klawak Reef.....	.....do.....	White wooden house on square skeleton structure on concrete pier.	36	Acetylenelens lantern.	Flashing white (flash 0.3 sec., eclipse 2.7 sec.).	130	40	9	2,341	Mar. 29, 1918
Middle Ground.....	Wrangell Strait.....	Black wooden house on white pile dolphin.	.....	.....do.....	Flashing white (flash 0.3 sec., eclipse 1.8 sec.).	10	23	4	600	Jan. 31, 1918
Point Crowley.....	Chatham Strait.....	White house on concrete base.	10	.....do.....	Flashing white (flash 0.3 sec., eclipse 2.7 sec.).	130	45	9	1,826	Apr. 7, 1918
Tonki Cape.....	Marmot Strait.....	White wooden house..	10	.....do.....	Flashing white (flash 0.3 sec., eclipse 2.7 sec.).	130	75	9	2,820	July 28, 1917

^a Discontinued Apr. 8, 1918.

SUMMARY OF IMPORTANT CONSTRUCTION AND REPAIR WORK UNDER GENERAL APPROPRIATIONS, COMPLETED DURING FISCAL YEAR 1918.

Station.	Cost.	Character of work.
FIRST DISTRICT.		
Stielman Rocks Beacon, N. H.	\$1,147	Purchased and set new iron spindle with day mark.
SECOND DISTRICT.		
Cape Cod Canal Range Lights, Mass.	1,857	Construction of, etc.
Cape Cod Canal Upper Range, Mass.	1,345	Stone riprap for protection.
Bakers Island Light Station, Mass.	1,401	Installing new oil engine in place of antiquated and worn-out engine.
Wings Neck Light Station, Mass.	5,271	Installing oil-engine outfit in duplicate, building fog-signal house, etc.
Pollock Rip Blue Light Vessel No. 73, Mass.	2,366	Docking, painting, repairs, etc.
Tender Azalea.	1,808	Do.
Do.	1,499	Docking, painting, etc.
Relief Light Vessel No. 66.	4,251	Installing new lantern gallery, making repairs to sheathing, repairing masts, installing new illuminating apparatus, etc.
THIRD DISTRICT.		
General Depot.	4,885	Purchase and installing electric elevator in north storehouse; raise grade of and lay concrete floor and rear-range chimney shed for a packing room.
New London Depot, Conn.	2,326	Dredging and removing 5,280 cubic yards of material around wharf.
Beavertail Light Station, R. I.	1,208	Reshingling with asbestos roof of dwelling and work-room, and made various repairs.
Borden Flats Light Station, Mass.	1,858	Built reinforced-concrete roof and pipe rail for main gallery and made various repairs.
Bristol Ferry Light Station, R. I.	1,301	Increased height of brick tower 6 feet; removed old wooden lantern, installed cast-iron lantern and deck, and made various repairs.
Bullock Point Light Station, R. I.	1,022	Removed old worn-out apparatus, and furnished and installed new fog-bell-striking apparatus.
New London Harbor Light Station, Conn.	1,165	Repainted walls, sealed and painted dwelling, white-washed tower, and made various repairs.
North Hook Beacon Light Station, N. J.	7,272	Razed old light tower, 2 dwellings, and siren house; built 35-foot steel tower with electric light; built new siren house and installed siren; moved to new site, built foundation for, rearranged and repaired dwelling for 2 keepers, and made various repairs to station.
Stratford Shoal Light Station, N. Y.	1,038	Made and installed 2 cast-iron siren horns; purchased and installed repair parts for fog-signal engines.
Tender Daisy.	1,885	Purchased and installed surface condenser and circulating pump; docked vessel and repaired and painted hull; made various repairs.
Tender John Rodgers.	2,707	Docked vessel, scaled and painted hull; overhauled and repaired boiler, paddle wheels, and wheel-houses, also guards; recanvased upper deck and made various repairs.
Tender Larkspur.	1,128	Repaired boilers; made and installed two radiators in fore-castle; braced steering engine foundation; rearranged piping of water tanks; furnished and laid carpet in four rooms, and made various repairs.
Tender Pansy.	3,294	Removed wood rail and built new steel rail forward; renewed guard and guard angles forward; repaired guard aft; made and installed new ash ejector; furnished and installed new galley stove; made various repairs.
Tender Tulip.	5,293	Made 12 cast-steel propeller blades; overhauled and repaired boilers; docked vessel; repaired and painted hull and installed propeller blades; rearranged quarters to accommodate wireless apparatus; scaled and painted bunkers; built hanging shelves and supports in forward hold; made various repairs.
Scotland Light Vessel No. 11, N. J.	1,313	Docked vessel and repaired hull; furnished and installed new anchor; repaired bulwarks and rail and removed catheads; made various repairs.
Relief Light Vessel No. 16.	2,067	Docked vessel and repaired hull; renewed part of mooring chain; repaired and welded port hawse pipe; made various repairs.
Relief Light Vessel No. 20.	5,401	Built and installed lantern gallery on foremast and furnished and installed acetylene illuminating apparatus; repaired rigging of masts; docked vessel and repaired hull; rearranged afterlantern house and built tank cradles and supports; removed forward lantern house and repaired deck; painted "cross rip" on sides of hull; made various repairs.
Cornfield Point Light Vessel No. 48, Conn.	1,355	Docked vessel and repaired hull; repaired damage from collision on starboard side and stem; removed portable top and decked over afterlantern house; overhauled power-boat engine and made various repairs.

SUMMARY OF IMPORTANT CONSTRUCTION AND REPAIR WORK UNDER GENERAL APPROPRIATIONS, COMPLETED DURING FISCAL YEAR 1918—Continued.

Station.	Cost.	Character of work.
THIRD DISTRICT—continued.		
Relief Light Vessel No. 51.....	1,275	Docked vessel and repaired hull; repaired boilers; put 3 new valves in auxiliary steam pipes; made various repairs.
Fire Island Light Vessel, No. 68, N. Y..	1,028	Renewed 5 sections of smokestack and repaired guys; docked vessel and repaired hull; purchased new set of evaporator tubes; repaired power-boat engine and hull; renewed wearing strips on starboard side; made various repairs.
Overfalls Light Vessel No. 69, Del.....	5,211	Furnished and installed acetylene illuminating apparatus on both masts; built tank houses aft; installed oak sheathing on both sides of hull; renewed part of mooring chain; repaired damage from collision to stern and life rail; made various repairs.
Relief Light Vessel No. 78.....	1,704	Docked vessel; repaired and painted hull; retubed and repaired both boilers; removed ash ejector and raised and reset filter box; built new skylight over galley; made various repairs.
Ambrose Channel Light Vessel No. 87, N. Y.	1,435	Docked vessel; repaired and painted hull; removed lead lining; removed and replaced rotten ceiling and repaired after lantern house; purchased new parts for and repaired air pump; made various repairs.
FOURTH DISTRICT.		
Fort Mifflin Bar Cut Range Rear Light Station, N. J.	1,308	A 3 $\frac{1}{2}$ -order lens installed; illuminant changed from oil to electricity.
Fourteen Foot Bank Light Station, Delaware Bay, Del.	1,453	New revolving lens installed.
FIFTH DISTRICT.		
Annapolis Depot, Md.....	2,737	Repairs to pierhead and wharf.
Portsmouth Depot Annex, Va.....	2,120	Repairing and extending wharf.
Washington Wharf, D. C.....	3,000	Repairs to wharf.
Buoyage.....	9,876	Altering 7 buoys to use compressed acetylene gas.
SIXTH DISTRICT.		
Charleston Lighthouse Depot, S. C.....	6,188	Installed power circuit; furnished and installed air-compressor plant and a shaper in lamp shop; and made some cinder fill for road foundation and grounds.
Jupiter Inlet Light Station, Fla.....	1,913	Installed water system consisting of a gasoline-engine-driven pump, a wooden tank on a steel tower, and distributing piping; repaired gallery rail of light tower; installed lightning conductor on tower and handrail on inside of tower.
Tybee Knoll Cut Range Light Station, Ga.	4,983	Raised tower on dwelling 16 feet and changed illuminating apparatus from a lens lantern to an oil reflector, using it for the rear instead of front light of range; constructed a new front range light on pipe tower on piles in front; constructed new boathouse and landing, tool house, and made general repairs.
Tender Cypress.....	8,000	Two dockings and general overhauling.
Tender Mangrove.....	1,148	Two dockings and minor repairs.
Frying Pan Shoals Light Vessel No. 94, N. C.	8,000	Two dockings and general overhauling.
Brunswick Light Vessel No. 84, Ga.....	2,878	One docking and minor repairs, also purchase of new condenser for main engine.
Relief Light Vessel No. 53.....	1,916	One docking and minor repairs; also installation of new circulating and air pumps.
Charleston Light Vessel No. 34, S. C....	1,534	One docking, renewing portion of metal sheathing, and minor repairs.
EIGHTH DISTRICT.		
Chefuncte River Range Front Light, La.	1,058	Rebuilding pyramidal structure on 4 iron-cased creosoted piles.
Galveston Jetty Light Station, Tex.....	11,633	Concrete block, 40 feet square around foundation piles and in places 10 to 15 feet in depth on northerly and southerly edges.
Heald Bank Light Vessel No. 81, Tex...	1,940	General repairs to hull and machinery.
Navy Yard Outer Bank Gas and Bell Buoy 19, Fla.	3,557	Establishment of gas and bell buoy.
Port Eads Depot, La.....	1,000	Entire new roof on one-half of depot building.
Tender Magnolia.....	10,557	General repairs to boilers, machinery, and hull.
Do.....	1,042	Renewing smokestack.
NINTH DISTRICT.		
San Juan Depot, P. R.....	4,170	The carpenter shop was rebuilt in reinforced concrete.
Anegado Range Rear, P. R.....	3,138	The old tower was erected on a concrete base in a new location.

SUMMARY OF IMPORTANT CONSTRUCTION AND REPAIR WORK UNDER GENERAL APPROPRIATIONS, COMPLETED DURING FISCAL YEAR 1918—Continued.

Station.	Cost.	Character of work.
TENTH DISTRICT.		
Buffalo Depot, N. Y.....	2,651	Constructed new launch No. 127.
Charlotte and Charlotte East Pier Light, N. Y.....	1,334	Installed electric generators with storage batteries to provide electricity for illuminant.
Galloo Island Light Station, N. Y.....	1,820	Constructed new launch No. 129.
Rock Island Depot, N. Y.....	1,482	Repaired buoy wharf and derrick.
Sandusky Depot, Ohio.....	8,143	Rebuilt inner part of wharf; relocated boathouse, drove pile dolphin fenders, and replaced broken castings on several piles.
Tender Crocus.....	71,322	Provided and installed new boilers, rebuilt boat deck and restored vessel to working condition.
ELEVENTH DISTRICT.		
Thunder Bay Island Light Station, Mich.....	2,000	Reconstruction of landing dock, repairs to water supply and construction of walk to boathouse.
Brush Point Range Light Station, Mich.....	1,385	Riprap stone protection for front light structure.
Portage Lake Ship Canals East Breakwater Light Station, Mich.....	1,603	Moving of steel tower to a new location on the outer end of breakwater and making necessary alterations for installation of acetylene lighting equipment. Acetylene light installed.
Mendota Light Station, Mich.....	2,709	Construction of revetment along the water front where shore erosion was taking place rapidly; also short groins for shore protection purposes.
West Neebish Channel Lights, 17-18, Mich.....	3,200	Pile foundations for both lights were entirely reconstructed and the old lighting equipment reinstalled.
Tender Marigold.....	19,400	A new set of boilers were constructed by the Duluth Boiler Works, at Duluth, Minn.
Lake Huron Light Vessel No. 61, Mich.....	1,983	The framing of vessel, including deck and deck planking, forward of main hatch, was largely renewed. New tubes were installed in the boiler and other minor repairs carried out.
TWELFTH DISTRICT.		
Charlevoix Depot, Mich.....	1,095	200 feet reinforced concrete revetment alongside creek and brush and earth fill at east end of revetment; general repairs to warehouse and dwelling.
Racine South Breakwater, Wis.....	3,019	Establishment of acetylene light on 31-foot 6-inch standard steel tower on concrete base; marks outer end of south breakwater.
Ile aux Galets, Mich.....	1,214	Fog signal, old duplicate locomotive boilers removed and replaced with duplicate compact marine boilers; roof of fog-signal building reshingled; sundry repairs to station buildings.
Grand Haven Pierhead, Mich.....	1,737	300-foot metal elevated walk rebuilt; repairs to station buildings and grounds.
Green Island, Wis.....	1,744	West boat dock extended 16 feet, with superstructure of concrete; new metal boatway built; roof of dwelling reshingled; assistant keeper's quarters remodeled and improved; sundry repairs to station building; grounds, well, etc.
Racine Pierhead, Wis.....	9,100	Reinforced concrete sea wall placed around dwelling pier; new cellars built; space inside pier filled and graded; old workshop removed and a brick tool and work shop built on concrete foundation; miscellaneous repairs to dwelling and boathouse; post light established to mark stub end of north pier.
Manistique, Mich.....	1,765	Intensity of light increased by replacing 300 mm. lens lantern with a fourth-order lens; duplicate electric motor-drive air compressor installed; air-cooling coils placed.
Milwaukee Depot, Wis.....	1,019	Alterations and improvements to warehouse; yard derrick overhauled and reerected.
Tender Hyacinth.....	2,088	General repairs and overhauling of vessel's deck and engine departments.
Lansing Shoal Light Vessel No. 55, Mich.....	1,029	Docking and general repairs to vessel; incidental repairs to engine and machinery; planking through bolted through frames and ceiling.
Eleven-Foot Shoal Light Vessel No. 60, Mich.....	1,126	Docking and general repairs to vessel; overhauling and incidental repairs to fog-signal equipment.
Tender Sumac.....	6,742	New steel deck placed from bow aft to cargo hatch; new refrigerator, crew bath, and lavatory put in with steel framing and siding; both main boilers retubed; incidental repairs to vessel's upper works and machinery.

SUMMARY OF IMPORTANT CONSTRUCTION AND REPAIR WORK UNDER GENERAL APPROPRIATIONS, COMPLETED DURING FISCAL YEAR 1918—Continued.

Station.	Cost.	Character of work.
SIXTEENTH DISTRICT.		
Sentinel Island Light Station, Alaska....	1,890	Constructed hoist house; installed double-drum gas engine hoist for derrick and trams; provided and equipped bathrooms in quarters for keepers; made miscellaneous repairs to double dwelling, and miscellaneous alterations in fog-signal building.
Tender Cedar.....	3,103	Miscellaneous repairs and improvements.
SEVENTEENTH DISTRICT.		
Marrowstone Point Light Station, Wash.	3,893	General repairs; moving and remodeling dwelling; installing sewer system, etc.
Warrior Rock Light Station, Oreg.....	1,842	General repairs and installation of modern plumbing, etc.
Salmon Bay Outer Light, Wash.....	1,361	Established acetylene light on dolphin.
Browns Point Light Station, Wash.....	4,400	Filling in swamp and grading grounds.
Columbia River Light Vessel No. 88, Oreg.	2,256	Dry docking and general repairs.
Umatilla Reef Light Vessel No. 67, Wash.	3,580	Do.
Tender Kukul.....	13,875	Do.
Tender Rose.....	1,375	Do.
Do.....	1,740	Steam steering-engine installation.
EIGHTEENTH DISTRICT.		
Humboldt Bay Fog Signal Station, Cal..	2,172	Built timber bulkhead to protect shore from erosion by wash of sea in front of oil house and fog-signal building.
Oakland Harbor Light Station, Cal.....	1,336	Installing B air diaphone, electric motor, and compressor in place of bell.
Seal Island Light and Echo Board, Cal..	1,018	5-pile beacon and echo board built and lens lantern installed.
Southampton Shoal Light Station, Cal..	1,973	Installing C air diaphone, gasoline engine, and compressor in place of bell.
Tender Sequoia.....	3,328	Docking, cleaning, painting, repairs to hull, general overhauling, and repairing of boilers and machinery.
Tender Madrono.....	2,235	Docking, cleaning, painting, repairs to hull; general overhauling and repairing of boilers and machinery; new foremast installed.
Relief Light Vessel No. 76.....	4,465	Docking, cleaning, painting, and general repairs to hull and machinery; installed new evaporator.
Blunts Reef Light Vessel No. 83, Cal....	3,985	Docking, cleaning, painting, repairs to hull; general overhauling of boilers and machinery, retubing starboard boiler; steam turbo-generator radio set installed.
NINETEENTH DISTRICT.		
Alla Point Light Station, Hawaii.....	6,156	Discontinued lens lantern light; erected 72-foot skeleton steel tower with reinforced-concrete tank house; furnished, installed, and placed in operation a 375-mm. gas-lighted lantern and equipment.
Kauhola Point Light Station, Hawaii...	1,110	Discontinued old lens lantern light and erected temporary frame tower; installed a fourth-order flashing lens with incandescent oil-vapor lamp, all of which was on hand at the depot; placed new light in operation.
Hanamanica Light Station, Hawaii.....	3,007	Erected reinforced-concrete tower; furnished, installed, and placed in operation a 300-mm. gas-lighted lantern and equipment; erected wooden derrick for landing accumulators from boat.
Diamond Head Light Station, Hawaii..	6,109	Dismantled the old tower with watchroom and lantern carried on temporary support; erected new reinforced-concrete tower up to and including watchroom deck; provided new cast-iron spiral stairway and made repairs and improvements to the watchroom lantern.
Honolulu Harbor Channel Light No. 4, Hawaii.	1,470	Discontinued the old 3-pile wooden structure and erected a 3-pile reinforced-concrete structure in new location.
Honolulu Channel Range Front and Rear Lights, Hawaii.	1,293	Established two electric incandescent range lights; front light on wharf shed roof, rear light on skeleton steel tower on roof of office building.
Waihee Reef Gas Buoy, Hawaii.....	2,256	Discontinued former Waihee Reef Whistle Buoys and established gas buoy in its place.
Lighthouse Wharf, Honolulu.....	1,553	Erected 20 by 30 foot wharf extension and 2 dolphins at lighthouse wharf for accommodation of the tender and the handling of buoys.

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ANNUAL REPORT
OF THE
COMMISSIONER OF LIGHTHOUSES

TO THE
SECRETARY OF COMMERCE

FOR THE
FISCAL YEAR ENDED JUNE 30, 1919



WASHINGTON
GOVERNMENT PRINTING OFFICE
1919

H. F. G.

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REPORT

OF THE

COMMISSIONER OF LIGHTHOUSES.

DEPARTMENT OF COMMERCE,
BUREAU OF LIGHTHOUSES,
Washington, September 15, 1919.

SIR: The following report is submitted of the operations of the Lighthouse Service for the fiscal year ended June 30, 1919:

SUMMARY OF MORE IMPORTANT ACTIVITIES OF THE YEAR.

The cooperation of the Lighthouse Service in the war activities of the Government continued throughout the year, nearly all of the lighthouse tenders and a number of other units serving with the Navy Department and at the same time continuing the work of maintaining aids to navigation.

Three important new light and fog-signal stations were established—at Lorain Harbor, Ohio; Sand Hills, Lake Superior, Mich.; and Lime Kiln, San Juan Island, Wash.—and three unwatched lights were placed on dangerous shoals in the Caribbean Sea. There was a net increase of 400 in the number of aids to navigation maintained by the Lighthouse Service, and the total is now 16,075. In Alaska 36 additional aids were established, making the total there 475, of which 180 are lights and 8 gas buoys.

The retirement law for the field force of the Lighthouse Service was put into effect in November, 1918, when funds became available, and has proved of great benefit. It is the first retirement provision for a civilian service in this Government, and includes light keepers, vessel employees, etc.

Radio equipment was installed on a large number of vessels during the year, and telephone connections made with many light stations, so that at the end of the year 40 light vessels, 23 tenders, and 139 light stations were equipped for communication, this work having been done largely by the cooperation of the Navy and Coast Guard. These installations add greatly to the means of communication along the coast and are a valuable protection to this and other Government services and to vessels generally.

Two small gasoline-driven vessels were transferred from the Navy Department for use as tenders in protected waters, and a small tender was built for use in the inlets on the New Jersey coast and a working barge for construction on the Hudson River. These were the only additions to the vessels of the Service during the year, and of course were quite inadequate to offset the deterioration of the fleet of the Service through age and the actual losses of vessels through casualties and condemnation.

More complete statements as to the foregoing are made on the following pages.

SUMMARY OF MORE URGENT NEEDS OF THE LIGHTHOUSE SERVICE.

1. Revision of pay schedules, so as to bring about a just relation according to duties and responsibilities between various branches of the Service, and particularly, new schedules with material increases of pay for certain classes who have shared but little, or not at all, in readjustments since conditions before the war; this applies particularly to the Bureau force in Washington, the technical and clerical forces in the districts, and to depot keepers.

2. Provision for replacing many of the vessels of the Lighthouse Service which have been lost or worn out in service or which will soon have to be condemned, as well as for adding reasonable vessel equipment to meet the considerable increase of the past 10 years in the aids to navigation maintained.

3. Increased maintenance appropriations to meet the continued increase in cost of supplies and labor and to enable proper repair and care of the great amount of exposed property, including vessels, under the charge of this Service.

4. Provision is greatly needed for improved depot facilities in several of the districts, particularly at or near Norfolk, Va.; Key West, Fla.; Honolulu, Hawaii; and Newport, R. I.; and additional funds are needed for the completion of the important depots at Boston, Mass., and Charleston, S. C.

5. Legislation is needed extending the retirement system in the Lighthouse Service to cases of disability incident to the work other than injury received in the line of duty, already provided for. The enactment of a general civil-service retirement law covering all persons in the Lighthouse Service not included under the present law is also strongly recommended.

More complete explanations of these and other recommendations are given later in this report.

COOPERATION WITH NAVY AND WAR DEPARTMENTS.

The lighthouse vessels and stations which had been operated under the jurisdiction of the Navy Department during the war were returned to the jurisdiction of the Lighthouse Service July 1, 1919.

In all, 46 tenders, 4 light vessels, and 21 light stations, with their personnel, a total of 1,132 persons, had been transferred to the Navy Department during the war. This was done under the act of August 29, 1916, which authorized the President, whenever in his judgment a national emergency exists, to transfer to the service and jurisdiction of the Navy Department or of the War Department such vessels, equipment, stations, and personnel of the Lighthouse Service as he might deem to the best interests of the country. The act provided that regulations governing this duty be prescribed jointly by the Secretary of the Navy, the Secretary of War, and the Secretary of Commerce. Such regulations were issued April 11, 1917, and on the same date the President by Executive order transferred 30 lighthouse tenders to the War Department and 15 lighthouse tenders, 4 light vessels, and 21 light stations to the Navy Department, including their personnel. The tenders transferred to the War Department were subsequently transferred to the Navy Department.

The Lighthouse Service, in addition to the work done by the tenders directly under the orders of the War and Navy Departments during the war, provided facilities at various depots for the berthing of naval vessels, and at the general lighthouse depot at Tompkinsville, N. Y., provided special coaling facilities and quarters for naval detachments. Additional buoys were placed and other changes in aids to navigation were made as required. A few minor lights were extinguished and buoys removed. Diamond Shoal light vessel was sunk by a German submarine, and temporarily replaced by a gas buoy. Necessary repairs to naval patrol boats were made at various points, and various buoys, moorings, and other appurtenances were transferred to or purchased for the Navy and War Departments. The Lighthouse Service also cooperated with the Navy Department and the Treasury Department in connection with improvements in coast communication facilities by telephone and radio and in the transmission of reports received from light stations.

Because the tenders of the Lighthouse Service are particularly well equipped for certain classes of work, such as the handling of buoys, moorings, etc., and their officers are thoroughly familiar with the coast line and waters of the United States, these vessels were effectively used by the War Department in mine-planting operations and by the Navy Department in laying submarine defense nets, etc., during the war and later in removing these defenses. Upon the occasion of the return of the tenders the district commandant of the fifth naval district stated:

The district commandant wishes to use this opportunity to express his high appreciation of the cordial cooperation of the Lighthouse Service in the solution of many problems arising during the period when they were under Navy control. The Lighthouse Service has responded quickly and efficiently to every demand made upon them by the naval district. The services of the lighthouse vessels were of immense value in the laying of submarine-defense nets and, after the armistice, in removing these nets. This was a task which would hardly be possible of accomplishment without the assistance of the lighthouse vessels.

AIDS TO NAVIGATION.

In addition to this cooperation with the military services, the regular work of the Service in maintaining and improving aids to navigation was actively carried on during the year. This required strenuous work on the part of the whole Service, and particularly the district and vessel officers by reason of the extra duties referred to above. During the fiscal year three important light and fog-signal stations were established from special appropriations, namely: At Lorain Harbor, Ohio, at the end of the west breakwater, to mark the entrance to the harbor; at Sand Hills, Mich., to mark a dangerous locality on the south shore of Lake Superior; and at Lime Kiln, San Juan Island, Wash., to mark an important point on the route from Puget Sound to British Columbia and Alaska. These works are described on pages 85 to 89.

Three unwatched acetylene lights were established in the Caribbean Sea to mark the traffic lane between the Gulf coast of the United States and the Panama Canal through Yucatan Passage. This important maritime track lies between low coral reefs and islands in the northwestern part of the Caribbean Sea and had never hitherto been lighted. The work was done in cooperation with the Navy

Department, which furnished a gunboat to transport the working party and materials.

An unwatched acetylene light was established at Dog Island, Me.

During the fiscal year ended June 30, 1919, there was a net increase of 400 in the total number of aids to navigation maintained by the Lighthouse Service. There was an increase of 36 lights, 14 float lights, 86 minor lights, and 283 unlighted aids.

On June 30, 1919, there were maintained by the Lighthouse Service 16,075 aids to navigation, including 5,665 lights of all classes and 583 fog signals (not including 79 whistle and 245 bell buoys), of which 49 are submarine signals.

The table following gives a summary of the aids to navigation, under each class, established and discontinued during the fiscal year, and also the net increase, and the number in commission at the end of the fiscal years 1918 and 1919.

Class.	1919			Total, June 30—	
	Estab- lished.	Discon- tinued.	Increase.	1918 ^a	1919
Lighted aids:					
Lights (other than minor lights).....	51	15	36	1,732	1,768
Minor lights.....	136	50	86	3,046	3,132
Light-vessel stations.....	1	3	b2	52	50
Gas buoys.....	73	80	b7	560	553
Float lights.....	6	2	4	159	162
Total.....	267	150	117	5,548	5,665
Unlighted aids:					
Fog signals.....	6	9	b3	537	534
Submarine signals.....		2	b2	51	49
Whistling buoys, unlighted.....		2	b2	81	79
Bell buoys, unlighted.....	94	7	2	243	245
Other buoys.....	301	142	159	8,896	7,055
Day beacons.....	154	25	129	2,319	2,448
Total.....	460	186	283	10,127	10,410
Grand total.....	736	336	400	15,675	16,075

^a Differences from statistics published in 1918 report are due to minor discrepancies in previous count.

^b Decrease.

Improvements in aids to navigation in the Service generally have been made during the year, as follows: Twenty fixed lights were changed to flashing or occulting (including 2 light vessels); the illuminant of 4 lights was changed to incandescent oil vapor; the illuminant of 27 lights (including 5 light vessels and 2 buoys) was changed to acetylene; the illuminant of 9 lights was changed to electric incandescent.

The fog signals at seven important stations were improved by the installation of air diaphones in place of less efficient apparatus.

Considerable work was done during the fiscal year in repairing damage to aids to navigation caused by ice floes during the winter of 1917-18, especially to screw-pile structures in Chesapeake Bay and the Potomac River. Much was also done in repairing hurricane damage to aids in the Gulf of Mexico, reconstructing stations, so far as practicable, in a manner calculated to better withstand future destruction.

The mild winter of 1918-19 presented a great contrast to the severe weather of the preceding winter and permitted the removal of buoys from their stations for the winter without loss or trouble, and in some cases buoys usually removed for the winter were kept on station throughout the year, which rarely happens in north Atlantic waters.

Various special works were actively in progress during the year, embracing the establishment of important new light and fog-signal stations and lighthouse depots, improvements in systems of fixed aids and buoyage, etc. Much of this work was well advanced at the close of the year.

General repairs required for upkeep of aids to navigation and maintaining them in efficient working condition were continued during the year so far as available funds permitted, but insufficiency of funds prevented this work being done to the extent needed for proper maintenance of this large amount of important public property.

On March 18, 1919, the unwatched light at Molokini Island, Hawaii, completed eight years of service without having been extinguished. This light was the first compressed acetylene light established on the Hawaiian Islands.

An earthquake and tidal wave of considerable intensity occurred in Porto Rico and vicinity on October 11, 1918. Lighthouse property was not seriously damaged, except at Point Borinquen and Point Jiguero Light Stations, which were practically wrecked.

Damage to lighthouse property, estimated at \$13,500 was sustained on December 8, 1918, by a fire at Execution Rocks Light Station, N. Y. The fog-signal engine and machinery, also the tower, oil house, and dwelling, were damaged.

ALASKA.

During the year 36 new aids were established in Alaska. Nineteen new lights were established; 4 lights were changed from fixed to flashing; 1 gas and bell buoy was established; also 13 unlighted buoys and 3 beacons.

The total number of aids to navigation in Alaska, including lights, gas buoys, fog signals, buoys, and daymarks, in commission at the close of the fiscal year ended June 30, 1919, was 475, including 180 lights and 8 gas buoys, representing an increase of 151 lighted aids since June 30, 1910, or 408 per cent. The following table, which gives the total number of aids to navigation on June 30 of 1910, 1915, and of each succeeding year, illustrates the progress in establishing aids in the Territory:

Aids.	1910	1915	1916	1917	1918	1919
Lights.....	37	112	147	152	161	180
Gas buoys.....				7	7	8
Fog signals.....	9	10	11	11	11	11
Submarine bell.....				1	1	1
Buoys.....	84	167	181	189	198	211
Daymarks.....	30	49	49	56	61	64
Total.....	160	338	388	416	439	475

The act of June 12, 1917, appropriated \$60,000 for establishing and improving aids to navigation in Alaskan waters. During the fiscal year 1919, eight acetylene lights and one gas and bell buoy were established with funds from these appropriations.

The sundry civil act approved July 19, 1919, appropriated \$75,000 for establishing new aids to navigation and improvements of existing aids. Additional special appropriations aggregating \$225,000 will be asked of Congress to continue the work of general increase of lights and buoys in Alaska, including a light and fog signal at Cape Spencer, Cross Sound, and other new aids, and improvements at existing stations.

The sundry civil act of July 1, 1918, contained an appropriation of \$90,000 for a lighthouse depot with necessary equipment for this district. The site has been cleared over the area to be occupied by warehouse, shops, etc., and the construction of the wharf was about 95 per cent completed and the entire project about 35 per cent completed on June 30, 1919.

GUANTANAMO, SAMOA, AND GUAM.

The act of July 1, 1918, appropriated \$14,000 for dwellings for keepers and improvements at Guantanamo Bay, Cuba. Preparations for this work are in progress.

The aids to navigation in the outlying United States territory at Guantanamo Bay, the American Samoan Islands, and the island of Guam are maintained under the supervision of the naval commanders by means of allotments made from the appropriations for the Lighthouse Service. Reports have been received from naval officers in local charge indicating that the aids have been properly maintained, at an approximate annual expense as follows: Guantanamo, \$4,555; Samoa, \$872; Guam, \$101.

VESSELS FOR THE UNITED STATES LIGHTHOUSE SERVICE—URGENT NECESSITY FOR REPLACEMENT OF VESSELS WORN OUT AND DESTROYED.

SERVICE PERFORMED BY LIGHTHOUSE VESSELS.

In the operation of this, the most extensive lighthouse service in the world, covering 47,300 miles of general coast line and rivers, there are at present employed 117 vessels, of which 54 are tenders and 63 are light vessels. The tenders are both supply ships and buoy tenders, carrying supplies and personnel to lighthouses and lightships, placing and caring for buoys, and doing construction, repair, and inspection work. They are the essential arteries of the Service, and keep up the most continuous and extensive patrol of the coasts of the United States. If anything is amiss with lightship, lighthouse, or buoy they are promptly dispatched in aid, and very frequently give succor to other vessels or persons or property in danger. The light vessels are the floating lighthouses, located in the most important positions for safeguarding shipping, and many of them on very exposed and hazardous stations off the coasts of the country. Equipped with distinctive lights, powerful fog signals, submarine bells, and radio communication, and guarding the dangerous points of the coast and the approaches to the great harbors, they are much the most indispensable of the aids to navigation.

No vessels are exposed to more severe usage than the vessels of the Lighthouse Service. The tenders are continuously on the go, handling buoys of great weight in proportion to the size of the vessel, as well as large quantities of coal and other supplies, and in working buoys must navigate close to the edges of reefs and shoals, and in waters which other vessels shun. The light vessels must remain at anchor in exposed positions off the coast during the most severe gales and hurricanes. The handling of buoys and supplies must often be done in a seaway under difficult or dangerous conditions.

RELATION TO OTHER GOVERNMENT ACTIVITIES.

The United States is making a very large investment in shipping. The total amount authorized or appropriated by Congress for the Emergency Fleet Corporation to October 15, 1918, was \$3,671,000,000, covering the purchase and construction of over 3,100 vessels, or more than double the total number of seagoing merchant vessels of the United States at the beginning of the war. The expenditures of the Navy Department for the construction of new vessels for the one fiscal year 1918 were about \$450,000,000. The expenditures for vessels for the Lighthouse Service should be considered as one of the relatively small items of insurance for this great investment of the Government in shipping, as well as for all the privately owned shipping of this country and the shipping of other countries which visits our shores. The United States expends about \$40,000,000 a year on river and harbor improvements, and the maintenance of the aids to navigation is indispensable to make these improvements useful to vessels.

PRESENT CONDITION OF VESSELS AND NECESSITY FOR UPKEEP.

The useful life of a lighthouse tender is about 25 years and of a light vessel about 30 years under normal conditions. The average age of the vessels of the Lighthouse Service is at present for tenders 22 years and for light vessels 28 years, and for each class this average has increased by 3 years since 1914, owing to lack of replacement of vessels. Of the light vessels now in use 20 are more than 30 years old, and of the tenders 17 are more than 25 years old. Twelve of the light vessels are over 50 years old.

To maintain 54 tenders and 63 light vessels, with a useful life as above stated, it is evident that on an average 2 tenders and 2 light vessels must be built each year, and the recommendations and estimates submitted have yearly emphasized this fact. In the 9 years since 1910, however, but 11 tenders and 7 light vessels have been built, a total of 18, or only one-half the number of replacements necessary to maintain the Service on its former basis without allowing for any increase. However, since 1910 the number of aids to navigation maintained by this Service has increased from 11,660 to 16,075, a total increase of 4,415 or 38 per cent, and three new districts, Alaska, Porto Rico, and Hawaii have been added; also the number of gas buoys maintained has increased from 225 to about 600, and the number of automatic gas shore lights has increased from 117 to about 600. All of these increases, and particularly the gas buoys and automatic shore lights, have added greatly to the work of the tenders, so that notwithstanding important economies in tender service that were effected at the

reorganization in 1910, the present number of tenders, even if they were efficient modern vessels, has become inadequate to maintain the Service as required in the interest of navigation. Many of the present tenders are, moreover, not capable of giving the efficient work required, because of their type (4 of them are side-wheel vessels built 36 or more years ago) and their not being designed to handle the heavy gas buoys which have been developed since they were built, their age (some of them are not sufficiently seaworthy to be sent on outside work), and the loss of time due to necessity for frequent repairs. Many of the present lightships are not suitable to be placed on exposed stations. The cost of repairs and overhaul becomes so heavy that it is not economical to keep in commission vessels after they have reached a reasonable limit of usefulness. The effect of continuing the use of these old vessels is often a greatly diminished output of work with the same or greater cost of operation and upkeep. Of more importance than the question of efficient and economical operation, however, is that of safeguarding life. Both lighthouse tenders and lightships are engaged on hazardous duty, and their officers and crews should not be required to serve on vessels which have passed a reasonable limit of usefulness, nor can the Lighthouse Service properly perform its part in the safeguarding of life and property on the navigable waters of this country without necessary vessel equipment.

RECENT CONDITIONS AFFECTING VESSELS.

The deficiency of vessels in the Lighthouse Service has been much accentuated by an unusual number of casualties in the last year and a half. Since January, 1918, Diamond Shoal Light Vessel has been sunk on station by a German submarine; Cornfield Point Light Vessel has been run into by a barge and sunk on station; Cross Rip Light Vessel has been destroyed by the ice; Thirty-five Foot Channel Light Vessel has been destroyed by fire at a contractor's dock; and Bush Bluff Light Vessel and the tender *Gardenia* have been condemned as worn out and not worth repair.

All of the tenders of the Lighthouse Service, excepting one, were by order of the President placed on duty with the Navy Department during the period of the war, and during this time from April, 1917, to July, 1919, have been performing various duties for that department in addition to doing their regular lighthouse work. Some of this naval duty, such as the handling of protection nets, has been strenuous work for these vessels. As a result of this, as well as the shortage of tenders and the difficulty of effecting repairs under war conditions, there has unavoidably been an unusual deterioration of vessels. Experience of the last two years has proven that the lighthouse vessels are of especial value in time of national emergency, which is an additional reason for the proper maintenance of these vessels. The tenders are the best available type of small vessel for handling moorings, nets, etc., and the light vessels are valuable signal stations at strategic points off the coast.

No appropriations for lighthouse vessels have been made since the act of June 12, 1917, or for more than two years. Of the appropriations made at that time that of \$150,000 for a tender for the third district has been impracticable to use, as the lowest bid received for the vessel was \$333,800, and, on readvertising, \$357,250, not includ-

ing equipping the vessel. The appropriation of June 12, 1917, of \$150,000 intended for two small light vessels for the Great Lakes was barely sufficient to contract for one such vessel. War conditions in the shipbuilding industry render it impossible to use several appropriations or balances of appropriations, which are quite insufficient under present shipbuilding costs. Under the appropriation of June 12, 1917, of \$130,000, for a light vessel, recent bids were \$297,000, \$396,700, and \$496,000 for the bare vessel, without outfit.

Due to war conditions and insufficiency of appropriations, no new contracts for large lighthouse tenders have been made since September, 1915, and since June, 1916, only one light vessel has been contracted for.

Very thorough investigation has been made as to the possibility of obtaining vessels suitable for work of the Lighthouse Service from the Shipping Board or from vessels no longer needed by the Navy on account of the cessation of the war. It was found that the Shipping Board had no vessels in any way suitable. From the Navy two small vessels have been transferred which will be used for shoal-water tender work, but they will be of but limited usefulness. Lighthouse tenders and light vessels are both vessels of unusual requirements, and it is impracticable to meet the special needs of this work by adapting vessels built for other purposes.

ESSENTIAL PROGRAM FOR MAINTENANCE OF VESSELS FOR LIGHTHOUSE SERVICE.

From careful estimates and examinations as to the condition and further serviceability of vessels of the Lighthouse Service, it is found that within the next five years 18 light vessels and 10 tenders, as shown in the following list, should be replaced with vessels of the types indicated, and one light vessel should be built for new station. As it will require under favorable conditions from two to three years after appropriation is made before vessels are available for service, funds should be provided now for 17 of these vessels most urgently needed, in addition to 3 vessels for which estimates have been heretofore submitted, two to be built under the authorization of June 20, 1918, and one to replace Diamond Shoal Light Vessel.

The vessels for which appropriation should be made now are the following, with estimated cost:

To replace Diamond Shoal Light Vessel:		Estimated cost.
Light vessel to replace No. 71, Diamond Shoal, fifth district, class 1..		\$450, 000
To be built under authorization of June 20, 1918:		
Tender to replace Jessamine, fifth district, class B.....		400, 000
Tender to replace Gardenia, third district, class B.....		400, 000
		<hr/> 800, 000 <hr/>
Additional vessels, authorization of which is now necessary:		
Light vessel for Barnegat, N. J. (new station), class 2.....		335, 000
Light vessel to replace No. 51, Relief, third district, class 2.....		335, 000
Tender to replace John Rodgers, third district, class B.....		400, 000
Tender to replace Holly, fifth district, class B.....		400, 000
Tender to replace Mistletoe, third district, class B.....		400, 000
Light vessel to replace No. 43, Relief, eighth district, class 2.....		335, 000
Light vessel to replace No. 20, Cross Rip, Mass., second district, class 2.		335, 000
Light vessel to replace No. 3, Handkerchief, Mass., second district, class 2.....		335, 000
Tender to replace Goldenrod, fourteenth district, inland rivers.....		100, 000

Additional vessels, authorization of which is now necessary—Continued.		Estimated cost.
Light vessel to replace No. 11, Scotland, N. J., third district, class 2.		\$335, 000
Light vessel to replace No. 44, Northeast End, N. J., third district, class 2.....		335, 000
Light vessel to replace No. 68, Fire Island, N. Y., third district, class 2..		335, 000
Light vessel to replace No. 69, Overfalls, Del., third district, class 2..		335, 000
Light vessel to replace No. 46, Tail of Horseshoe, Va., fifth district, class 2.....		335, 000
Light vessel to replace No. 56, North Manitou, Mich., twelfth district, class 3.....		160, 000
Light vessel to replace No. 57, Grays Reef, Mich., twelfth district, class 3.....		160, 000
Light vessel to replace No. 60, Eleven-Foot Shoal, Mich., twelfth district, class 3.....		160, 000
Total.....		5, 130, 000

On May 15, 1919, in a letter to the Speaker of the House of Representatives in connection with legislation affecting the Lighthouse Service, this Department requested that a provision be included authorizing the "Constructing or purchasing and equipping light-house tenders and light vessels for the Lighthouse Service, \$5,000,000." This, with the estimates pending, would provide for the above immediate necessities. The large number of new vessels required now is directly due to the conditions of recent years which have prevented replacement of vessels in this Service at a proper rate. The situation is not unprecedented, however, for in the sundry civil act of March 4, 1907, appropriations were made for building or completing 21 light vessels and tenders, and an amount of \$2,180,000 was included for vessels. For 10 of these vessels there had also been previous appropriations.

The building of vessels for this Service should not be deferred on account of present shipbuilding costs. The expense will undoubtedly be materially higher than the costs a few years back, but there is no likelihood of any early reduction in building costs. This replacement of vessels has already been so repeatedly deferred on account of war conditions that the fleet of this Service is in a seriously depreciated condition, which can not safely be permitted to continue. The costs of these vessels, on a tonnage basis, will be higher than costs announced by the Shipping Board for building fabricated ships for these reasons: The lighthouse vessels are small and of a special type, will be built in small numbers, and must be unusually staunch for their size. Also, the Shipping Board per-ton price does not include investment and depreciation of plant, which, of course, every contractor must include in bidding on work. The Lighthouse Service can, however, undoubtedly obtain more favorable bids by constructing, as is proposed, several vessels of one type at one time. The following are some comparisons as to the costs of vessels of small size and special types, somewhat comparable with the required vessels for the Lighthouse Service. In January, 1919, the Coast Guard contracted for building five cutters at \$687,000 each. These vessels are of 1,200 tons construction weight, or will cost \$572 per ton. The tender *Cedar*, completed in 1917, according to sworn statements of the contractors, cost \$448 per ton construction weight to build; since 1917 there has been material increase in cost of shipbuilding. The lowest bids, received within the past year, were \$565 per ton for the tender *Oak*, and \$539 per ton for a vessel for the Coast

Survey. The recent contract price for steel barges for the upper Mississippi River was at \$401 per ton; these barges are of much simpler construction than seagoing vessels. The above comparisons are on the basis of construction weight, which is the actual weight of vessel without supplies or load.

List of lighthouse vessels requiring replacement within the next five years (not allowing for any losses of vessels).

Vessel.	Age.	Remarks.	Replace by—	Necessary to build.
LIGHT VESSELS.				
No. 71, Diamond Shoal.	Yrs.	Sunk by submarine.	New ship.	Class 1, light vessel.
No. 51, Relief.		Sunk by collision.	do.	Class 2, light vessel.
No. 55, Lansing Shoal.	28	Worn out.	Light vessel No. 99. (building).	Do.
No. 43, Relief.	38	do.	New ship.	Do.
No. 20, Cross Rip.	52	do.	do.	Do.
No. 62, Bar Point.	26	do.	Canadians will provide.	
No. 61, Huron.	26	do.	Light vessel No. 103. (building).	
No. 3, Handkerchief.	67	do.	New ship.	Class 2, light vessel.
No. 11, Scotland.	66	do.	do.	Do.
No. 44, Northeast End.	37	do.	do.	Do.
No. 68, Fire Island.	22	do.	do.	Do.
No. 69, Overfalls.	22	Less exposed station.	do.	Do.
No. 46, Tail of Horse-shoe.	32	Worn out.	do.	Do.
No. 56, Moulton.	28	do.	do.	Class 3.
No. 57, Grays Reef.	28	do.	do.	Do.
No. 60, Eleven-Foot Shoal.	26	do.	do.	Do.
No. 72, Pollock Rip Shoal.	18	Less exposed station.	do.	Class 2, light vessel.
No. 48, Cornfield.	28	Worn out.	Light vessel No. 73.	
No. 34, Charleston.	55	do.	New ship.	Class 1, light vessel.
No. 70, San Francisco.	22	do.	do.	Do.
No. 39, Brenton Reef.	44	do.	Light vessel No. 69.	
TENDERS.				
Jessamine.	38	Worn out.	New tender.	Class B, tender.
Gardenia.	40	Condemned.	do.	Do.
John Rodgers.	36	Worn out.	do.	Do.
Holly.	38	do.	do.	Do.
Mistletoe.	47	do.	do.	Do.
Goldenrod.	31	do.	do.	Class special.
Arbutus.	40	do.	do.	Class B, tender.
Lilac.	27	do.	do.	Class A, tender.
Snowdrop.	23	do.	do.	Class B, tender.
Myrtle.	47	do.	do.	Do.

Additional vessels required for new station.

Light vessel, Barnegat, N. J.	Class 2
Tender for Alaska.	Class B

General types of vessels proposed.

Vessel.	Length.	Construction weight.		Estimated cost.
		Tons.	Cost per ton.	
LIGHT VESSELS.				
	Feet.			
Class 1, most exposed stations.....	147	615	\$650	\$400,000
Class 2, exposed stations.....	135	515	650	335,000
Class 3, Great Lakes stations.....	96	240	650	160,000
TENDERS.				
Class A, seagoing.....	190	1,000	650	650,000
Class B, coastwise.....	170	620	650	400,000
Class special, inland rivers.....	150	250	400	100,000

ADMINISTRATION.

The pay question is a very serious one throughout the Lighthouse Service. The bonus increases made by Congress have proved inadequate to meet the difficulty, and consequently do not satisfy the personnel. This bonus averages about 10 per cent to 15 per cent over prewar salaries, which is very much less than the well-authenticated figures as to the increased cost of living during the same period. Discontent is increased by the fact that in certain classes of occupation, both without and within the Government service, increases of compensation have been made, equaling or exceeding the increased cost of living, and that in the organization of new Government activities much higher scales of compensation have been set. Within the Lighthouse Service itself serious inequalities have arisen through the inability to extend throughout the Service the same proportionate increase made in certain occupations because of the action of outside Government boards. Serious discrepancies result, which the estimates submitted will endeavor to correct. The complaints of the actual difficulty of living decently and supporting a family on the present compensation in some grades are known to be well founded. Such adjustments as possible to meet the situation have been made.

Much difficulty has been had in maintaining sufficient and efficient complements on vessels of the Lighthouse Service, notwithstanding increases of pay scales. Great credit is due to many of the officers of these vessels for their loyal work and standing by the Service under these difficult conditions.

A revised schedule of pay for keepers of lighthouses was put in effect on November 1, 1918, upon the appropriation by Congress of funds for carrying out the provisions of the act of June 20, 1918, increasing the average pay of keepers from \$600 to \$840 per annum.

The general organization of the Service remained unchanged during the fiscal year.

The appropriations for the maintenance of the Lighthouse Service for the fiscal year 1920 were \$1,054,600 less than the estimates submitted, and additional funds will be necessary for even the minimum maintenance of the Service during this fiscal year; for this deficiency estimates will be submitted. During the last fiscal year \$774,000 was transferred from Navy Department appropriations to make good deficiencies in the maintenance of the Lighthouse Service, but as the vessels and stations were transferred back on July 1, 1919, funds will not be available from the similar provisions in the Naval appropriation act this year.

The Department approved regulations for the distribution of Lighthouse Service publications on a sales basis, pursuant to act of Congress of June 20, 1918, and this was put in effect January 1, 1919. Sales agencies have been established at the principal ports, and include marine dealers and various Government officers. Returns of sales are made to the Superintendent of Documents, Washington, D. C., who supplies agents with the necessary copies of the publication and accounts for the proceeds.

Systematic inspections have been continued in the various lighthouse districts of the technical work, business methods, and property accounts.

In order to take advantage of local markets, the Department authorized the sale of such empty oil cans as may accumulate at light stations, etc., without the usual method of condemnation and sale. This has proved advantageous to the Government.

The President on February 25, 1919, signed a proclamation reserving for lighthouse purposes the southwest cay of Serrano Banks, also such suitable portions of Quito Sueno Banks, located in the western part of the Caribbean Sea, as the Department may desire, also Roncador Cay, by proclamation, signed June 5, 1919.

On April 8, 1919, and June 2, 1919, respectively, the President, by proclamation, restored to the control of the government of Hawaii property of the Lighthouse Service no longer needed for lighthouse purposes, situated at McGregor Point, on the island of Maui, containing about 4.2 acres, and 256 square feet at Honolulu, Hawaii.

On April 16, 1919, the President, by Executive order, reserved for lighthouse purposes three unsurveyed islands in the Straits of St. Mary, an arm of Lake Huron, known as Squaw Island and Pipe Island Twins.

On April 22, 1919, the President, by Executive order, reserved for lighthouse purposes fractional sec. 32, T. 15 S., R. 15 W., Louisiana meridian, La., containing 45.56 acres. The reservation is located at Sabine Pass, La.

ENGINEERING AND CONSTRUCTION.

The most important items of construction work completed during the fiscal year were the new light and fog-signal stations at Lorain Harbor, Ohio; Sand Hills, Mich.; and Lime Kiln, San Juan Island, Wash. Three acetylene lights were established in the Caribbean Sea. An unwatched acetylene light was established at Dog Island, Me. Eight acetylene lights were established in Alaska. Riprap was placed as a protection against ice at various light stations on Chesapeake Bay and Potomac River. These works are described on pages 84 to 89.

Improvements consisting of electric lighting installation and electric welding equipment at Woods Hole (Mass.) Lighthouse Depot were completed.

Other important works in progress at the close of the fiscal year included: Riprap at Duxbury Pier and Scituate Breakwater Light Station, Mass.; aids to navigation, Hudson River, N. Y.; aids to navigation, East River, N. Y., Great Salt Pond Light Station, R. I. improvements; Hunts Point, N. Y., light and fog signal; Staten Island Lighthouse Depot, N. Y., rebuilding wharves, coal sheds, and other improvements; Ambrose Channel, N. Y., improving buoyage; aids to navigation, Delaware River, Pa. and Del.; Joe Flogger Shoal, Del., improving aids; Cape Charles City, Va., improving lights and fog signals; Chesapeake Bay, Md. and Va., improving aids to navigation; repairing ice and storm damage, Chesapeake Bay and Potomac River. Improving buoyage, fifth district; aids to navigation, St. Johns River, Fla.; repairing and rebuilding aids to navigation damaged by storm and ice, Atlantic coast; repairing and rebuilding aids to navigation, Florida Reefs, Fla.; repairing and re-

building aids to navigation damaged by hurricane, Gulf of Mexico and Mississippi River below New Orleans, La.; improving aids to navigation Conneaut Harbor, Ohio; establishing aids to navigation, Huron Harbor, Ohio; improving aids to navigation, Fairport Harbor, Ohio; aids to navigation, Keweenaw Waterway, Mich.; aids to navigation, St. Marys River, Mich.; repairing Spectacle Reef Light Station, Mich.; improvements at Detroit Lighthouse Depot, Mich.; improving aids to navigation, Detroit River, Mich.; establishing a light and fog signal at White Shoal, Mich.; rebuilding Chicago Harbor Light Station, Ill.; aids to navigation, Indiana Harbor, Ind.; improving aids to navigation, Alaska; establishing a light-house depot at Ketchikan, Alaska; improving aids to navigation, Puget Sound, Wash.; improving aids to navigation Washington and Oregon; aids to navigation, Pearl Harbor, Hawaii. These works are described on pages 50 to 57.

IMPROVEMENT OF APPARATUS AND EQUIPMENT.

Radio equipment was installed on 32 light vessels and on 16 tenders during the fiscal year. At the end of the fiscal year 40 light vessels and 23 tenders in all had been equipped with radio installations.

The installation of telephones at light stations was continued during the year. This work was done by the United States Coast Guard under an appropriation made by act of June 12, 1917, to develop coastal communications, including connections with important light stations. On June 30, 1919, there were 139 light stations so connected.

Experiments and tests continued during the fiscal year with various devices and equipment used in lighthouse work have resulted in developing improvements in the interests of efficiency and economy in the service. Among these may be mentioned improvements in diaphone installations, resulting in simplicity of operation, reduced space required for machinery, and lowered initial cost. A new type of metal buoy was developed for use in defining shoal-water channels, being an improvement over wooden spar buoys which are less conspicuous as aids and more expensive to maintain under ice conditions. The stability of the type L gas and bell buoy, where moored in the exposed waters of Alaska and likely to be weighted with ice, was improved.

An experiment carried out to determine whether a bell buoy can be arranged to give a definite characteristic has been successfully accomplished by the installation on a gas buoy of a bell operated by compressed carbon-dioxide gas in storage tanks. The tanks are located in one of the pockets of the buoy, and the bell sounds continuously one stroke every 15 seconds. The buoys successfully replaced a light vessel.

On account of immunity from wood-boring worms the use of palmetto piles has been extended in southern waters.

An improved device for fastening moorings to buoys in the upper Mississippi River was tested and proved satisfactory.

Investigation of the use of radio for fog-signal purposes was interrupted by war activities. Recently the Navy Department has estab-

lished a number of radio-compass stations equipped to furnish bearings to vessels. Further investigation of the possibilities of radio signals for aiding vessels in fog is in progress.

An improved method of making concrete sinkers for buoys in one of the river districts was adopted with satisfactory results.

PERSONNEL.

On June 30, 1919, there were 5,964 persons employed in the Lighthouse Service, including 125 technical, 156 clerical, and 5,683 employees connected with light stations, vessels, and depots. This Service is charged with the maintenance of aids to navigation along 47,300 statute miles of general coast line and river channel.

The following table gives the number of employees (all authorized employees, including some vacancies) of the Lighthouse Service at the end of the fiscal year and a comparison of the totals with those for the previous fiscal year:

EMPLOYEES IN THE LIGHTHOUSE SERVICE ON JUNE 30, 1919.

District.	Superintendents, engineering force, draftsmen, aids, appointed foremen, and mechanics.	Clerks, messengers, janitors, and office laborers.	Depot keepers and assistants, including laborers.	Light keepers and assistants.	Laborers and laborers in charge of lights (appropriation "Salaries, keepers of lighthouses").	Laborers in charge of post lights and buoys (appropriation "General expenses").	Custodians of reservations.	Officers and crews on tenders and light vessels.	Field force for construction and repair (registered).	Field force for construction and repair (unregistered).	Total.
Bureau.....	17	27									44
First.....	3	6	1	114	3			71	9	6	213
Second.....	4	7	2	79	11		2	220	6	11	342
Third.....	21	34	16	179	32	54	2	285	179	45	847
Fourth.....	6	5	3	57	3	4	6	32	5	4	125
Fifth.....	11	10	45	165	94	20		287	4	11	647
Sixth.....	5	7	2	55	10	25		140	12	10	266
Seventh.....	2	3	1	41	1	7		37	5	10	107
Eighth.....	7	9	16	110	33	35		121	8	24	363
Ninth.....	3	5	1	41	10			24	4	3	91
Tenth.....	7	5	2	69	1		1	28	5	20	138
Eleventh.....	9	6	6	161	9	2	2	113	13	46	367
Twelfth.....	9	6	5	156	17	2		98	5	8	306
Thirteenth.....	1	2				309		19			331
Fourteenth.....	1	2				536					539
Fifteenth.....	1	2				364		20			387
Sixteenth.....	5	5	1	36		27		53		25	152
Seventeenth.....	6	6	5	81	15	123		130	6	6	378
Eighteenth.....	6	6	7	106	13	5		94	4	10	251
Nineteenth.....	4	3	1	27	2			30		6	73
Total, 1919.....	128	156	114	1,477	254	1,513	13	1,802	205	245	5,967
Total, 1918.....	120	150	107	1,457	256	1,524	14	1,736	276	259	5,899
Increase.....	8	6	7	20				66			68
Decrease.....					2	11	1		11	14	

The retirement system for the field service of the Lighthouse Service was put in effect upon the appropriation by Congress of the necessary funds by act approved November 4, 1918. By the same act the retirement law was amended to the extent that the provisions of the law do not apply to persons in the field service whose duties do not require substantially all their time. The number of retirements up to June 30, 1919, was 100, including 88 persons 70 years and over. The effect of the retirement system has been very advantageous both to the Service and the personnel, and at a moderate expense.

Up to June 30, 1919, a total of 152 persons from the Lighthouse Service, exclusive of those transferred by Executive order, had entered the Army or Navy, making with those transferred a grand total of 1,284 employees who have entered the military services, or 23 per cent of the normal force of the Lighthouse Service.

The employees of the Lighthouse Service subscribed liberally to the fifth Victory Liberty Loan, as well as to previous Liberty Loans. They have also liberally purchased War Saving Stamps and displayed commendable activity in the food-conservation campaigns.

The Comptroller of the Treasury has made a decision that lighthouse employees who have been transferred to the service and jurisdiction of the Navy Department by Executive order are not entitled upon discharge to the \$60 bonus provided by act of February 24, 1919, for persons serving in the military or naval service of the United States during the war.

The Acting Secretary of the Treasury on March 22, 1919, advised that light keepers and officers and crews of vessels, after being retired, are not entitled to the benefits of the Public Health Service free of charge.

During the fiscal year services in saving life and property were rendered and acts of heroism performed by employees of the Lighthouse Service on 111 occasions. Many of these acts were considered especially meritorious and the employees were individually commended by the Secretary of the Department. A list in detail of services rendered is given on pages 59 to 63.

Ralph H. Goddard, superintendent of the second lighthouse district, died March 4, 1919. Mr. Goddard entered the Lighthouse Service in 1887 and served continuously until his death. His record is a creditable one, he having worked his way up solely on personal merit through the various grades of employment on lighthouse vessels and in the supply department at the general lighthouse depot. In June, 1912, he was placed in charge of the second lighthouse district, holding this position at the time of his death.

The keeper and one of the assistant keepers at Sand Island Light Station, Ala., were missing when the station was visited in January, 1919, to investigate a report of the extinguishment of the light. Nothing has been learned as to the fate of these two men, but it is supposed that they lost their lives by the capsizing of their launch while going ashore for the purpose of taking to the station another assistant keeper who had been ashore on leave.

COST-KEEPING SYSTEM AND RESULTS.

The system of cost keeping for the service was modified, reducing the amount of detail work required in district offices without sacrificing the more essential data furnished. This modification was necessary in order that other important work, increased by the extra work due to war conditions, might be kept up.

A generalized summary of costs for the fiscal year ended June 30, 1919, follows, as derived from this cost-keeping system. The figures given are inclusive of amounts paid employees from the appropriation increase of compensation, Department of Commerce. Notwithstanding the most careful and painstaking efforts to economize in every direction, the continued extraordinary advance in the price of labor and materials is clearly shown in the increased cost reported for practically all features.

SUMMARY OF COSTS, LIGHTHOUSE SERVICE, FISCAL YEAR ENDED JUNE 30, 1919.

[Amounts are stated to nearest even dollar, causing occasional minor discrepancies in totals. Difference from total expenditures reported elsewhere is due to inclusion of Bureau salaries, printing expenses, and adjustment of inventories of articles furnished from stock.]

TOTAL COSTS OF PRINCIPAL FEATURES.

Feature.	Maintenance expenses.				Betterment expenses.				Grand total.	Per cent.	
	Salaries.	Subsistence.	General supplies.	Incidental expenses.	Total.	Repairs and improvements.					Total.
						Hired labor.	Materials.	Contract work.			
Administration a.....	\$357,350	\$24,723	\$25,057	\$5,411	\$412,541					\$412,541	5
Distributive charges b.....	1,209,614	251,746	700,698	45,483	2,207,541	\$70,811	\$98,582	\$136,224	\$134,466	2,647,624	35
Aids to navigation c.....	2,160,367	358,333	686,304	16,010	3,221,034	152,689	295,181	163,438	698,680	4,531,031	60
Total.....	3,727,331	634,822	1,412,059	66,904	5,841,116	223,500	393,763	299,662	833,155	7,591,196	100

TOTAL COSTS OF DETAILED FEATURES.

Offices.....	\$357,350	\$24,723	\$53,704	\$5,411	\$441,188					\$441,188	6
Depots.....	225,789		141,298	24,363	391,450	\$24,129	\$26,761	\$7,027	\$191,576	583,026	8
Tenders:											
Large.....	231,735	60,485	186,065	4,895	483,180	6,345	10,749	29,998	47,342	530,522	7
Medium.....	681,006	174,741	308,778	15,136	1,179,661	31,838	41,413	74,917	148,720	1,328,381	17
Small.....	71,083	16,520	35,910	1,089	124,602	8,499	19,659	24,282	52,445	177,047	2
Total.....	983,824	251,746	530,753	21,120	1,787,443	46,682	71,821	129,197	248,507	2,035,950	26
Light vessels:											
Exposed.....	265,521	53,225	63,632	2,914	385,292	5,835	22,350	65,539	93,733	479,026	6
Moderately exposed.....	169,419	34,051	26,478	710	230,658	11,979	28,003	35,917	75,899	306,557	4
Relief.....	87,337	19,325	21,131	468	128,261	2,951	21,541	18,163	42,655	170,916	2
Lakes.....	68,503	18,614	11,675	389	99,181	2,930	2,980	1,405	19,292	125,788	2
Total.....	590,780	125,214	122,916	4,481	843,392	23,665	74,883	121,024	238,894	1,082,287	14

Light stations: Primary seacoast and lake lights..... All other lights except post lights..... Post lights..... Day marks and spindles.....	361,193	71,717	94,438	4,244	531,592	21,350	28,070	6,431	77,517	133,368	664,960	9
	931,090	161,422	213,038	5,102	1,310,652	86,573	164,623	30,304	515,257	798,757	2,107,409	28
	243,565	.....	34,150	2,183	279,898	2,147	8,437	785	12,105	23,474	303,372	4
	57	.....	440	.....	497	1,359	1,689	1,193	1,101	5,342	5,839	.....

Total.....	1,535,905	233,139	342,066	11,529	2,122,639	111,429	202,819	38,713	605,980	958,941	3,081,580	41
Buoys.....	33,681	.....	221,322	.....	255,003	17,565	17,479	3,701	73,417	112,162	367,165	5

	3,727,331	634,822	1,412,059	66,904	5,841,116	223,500	393,763	299,662	833,155	1,750,080	7,591,196	100
Grand total.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

AVERAGE COST OF SELECTED FEATURES.

Average cost of—	Salaries.	Subsist- ence.	General supplies.	Incidental expenses.	Total mainte- nance.	Repairs and im- provements.	Total cost.
District office, exclusive of third.....	\$13,840	\$449	\$432	\$296	\$15,017	.....	\$15,017
District depot, exclusive of third.....	9,332	.....	2,518	1,057	12,907	\$2,572	15,479
Large tender, Pacific.....	31,352	8,373	29,310	307	69,341	2,435	71,776
Large tender, Atlantic.....	31,927	8,196	13,966	785	54,873	8,272	63,144
Medium tender.....	23,424	5,998	9,567	489	39,477	4,218	43,695
Exposed light vessel.....	13,178	2,640	3,174	142	19,134	4,677	23,811
Moderately exposed light vessel.....	8,782	1,775	1,447	35	12,040	3,986	16,026
Lake light vessel.....	5,269	1,431	898	30	7,629	563	8,192
Primary seacoast light station.....	2,474	491	646	29	3,640	382	4,024
Other light station (except post lights).....	432	80	99	2	613	132	744
Post light, river district.....	91	.....	6	1	98	1	99
Post light, other district.....	100	.....	28	1	129	12	141

^a Includes offices, except expenses of publications.

^b Includes depots and tenders; also item excepted above, charged to supplies.

^c Includes light vessels, light stations, minor fixed aids, and buoys.

APPROPRIATIONS AND EXPENDITURES.

The appropriations for the maintenance of the Lighthouse Service for the fiscal year 1920 were \$6,690,430, being \$255,568 in excess of those for the preceding fiscal year and include \$45,000 for retired pay. These appropriations were \$1,054,600 less than the estimates submitted. The appropriations for special works made for the fiscal year 1920 amounted to \$354,400.

On October 1, 1918, an allotment of \$100,000 was made from the appropriation for national security and defense for establishing necessary lights in the Caribbean Sea.

The average appropriations for special works for the 10 preceding years, 1910 to 1919, inclusive, amounted to \$577,668.

The detailed estimates for the fiscal year 1921 are given on page 69. The total amount for general maintenance is \$1,694,238.40 more than the appropriation for the present year. Particular attention is again invited to the urgent need of the Lighthouse Service for additional funds. The increase in the cost of all materials has continued, salaries and wages have been or must be advanced, and in order that the Service may be maintained at a proper standard of efficiency a corresponding increase in its appropriations is necessary. The Bureau desires to lay special stress on this matter, and on page 14 includes a more detailed statement with reference to pay.

Increases are urgently needed in the pay scale of the Bureau of Lighthouses in Washington, and it is understood this general subject will be considered by the Joint Commission on the Reclassification of Salaries.

Estimates for 22 special works have been submitted, aggregating \$7,989,500 considering only group 1, of which items amounting to \$1,423,000 are authorized by law. This estimate is \$7,635,100 more than the appropriation for special works for the preceding year, and includes a number of important works for which estimates were submitted last year, but which were not included in the appropriations. The estimates include 6 new lighthouse tenders, 14 new light vessels, 4 new lighthouse depots, 3 items for establishing or improving aids in general localities, 5 items for improvements of harbor or channel lights and other aids, 2 items for establishing or completing light and fog-signal stations, and 4 items for improvement of lighthouse depots.

In selecting and submitting estimates for these special works believed to be most important, there were considered estimates submitted by officers in the various districts and others for new lighthouse and ship construction aggregating about \$9,920,000. Many items not included in the estimates for this year are thought to be meritorious, and the more important of them are included in group 2 of the estimates for special works, submitted for consideration as the resources of the Government permit them to be taken up. Explanation of the necessity for each of the items of special works is included with the estimates.

The tables following give comparisons of appropriations and expenditures for the Lighthouse Service, beginning with the fiscal year 1916 and including the estimates for 1921.

APPROPRIATIONS, LIGHTHOUSE SERVICE, FISCAL YEARS 1916-1920, WITH ESTIMATES FOR 1921.

[The salaries and allowances of officers of the Army on duty with the Lighthouse Service are not included in this table.]

Item.	Appropriations.					Estimates.
	1916	1917	1918	1919	1920	1921
MAINTENANCE.						
Salaries, Bureau of Lighthouses..	\$64,030	\$64,030	\$64,030	\$65,430	\$65,430	\$79,668.40
Salaries of keepers of lighthouses..	940,000	940,000	940,000	1,194,432	1,300,000	1,330,000.00
General expenses, Lighthouse Service.....	2,775,000	2,790,000	2,850,000	3,500,000	3,500,000	4,300,000.00
Salaries, lighthouse vessels.....	1,010,000	1,070,000	1,104,650	1,265,000	1,400,000	2,100,000.00
Salaries, Lighthouse Service.....	375,000	375,000	380,000	380,000	380,000	490,000.00
Retired pay, Lighthouse Service.....				30,000	45,000	85,000.00
Total for maintenance.....	5,164,030	5,239,030	5,338,680	6,434,862	6,690,430	8,384,668.40
Unexpended balances (obligations estimated).....	47,171	67,377	14,100	66,283		
SPECIAL WORK.						
New light and fog-signal stations.....		193,000	155,000	80,000	6,400	169,600.00
Light vessels.....			280,000			4,150,000.00
Lighthouse tenders.....	250,000	20,000	210,000			2,060,000.00
Keepers' dwellings.....					50,000	
Improvement of aids.....		738,000	613,000	795,000	268,000	481,850.00
Lighthouse depots.....		50,000	21,000	288,000	30,000	1,128,050.00
Total for special works.....	250,000	999,000	1,279,300	1,163,000	354,400	7,989,500.00
Total maintenance and special works.....	5,414,030	6,238,030	6,617,980	7,597,862	7,044,830	16,374,168.40

EXPENDITURES FROM APPROPRIATIONS, LIGHTHOUSE SERVICE, FISCAL YEARS 1915-1919.

[Actual expenditures, regardless of year of appropriation.]

Expenditures.	1915	1916	1917	1918	1919
For maintenance.....	\$5,111,121	\$5,002,706.25	\$5,220,473.07	\$6,246,088.83	\$6,694,537.90
For special works.....	500,516	748,833.50	651,298.99	499,633.24	880,958.40
Total.....	5,611,637	5,751,539.75	5,871,772.06	6,745,722.07	7,575,496.30

In addition to the appropriations listed above, funds have been received from the Navy Department, or are to be transferred as required, in payment of expenditures and obligations by the Lighthouse Service during the fiscal year 1919, on account of vessels and stations temporarily transferred to that department, and for which the appropriations of the Lighthouse Service were to that extent insufficient, as follows:

To credit of general expenses, Lighthouse Service, 1919.....	\$625,000
To credit of salaries, lighthouse vessels, 1919.....	200,000
Total.....	825,000

The amount transferred to the credit of salaries, lighthouse vessels, 1919, proved to be in excess of that required, and the unused balance will be returned to the Navy Department as soon as all obligations are ascertained.

Financial benefits not included in the above statement were received by the Lighthouse Service from the following sources:

During the fiscal year 1919 employees of the Lighthouse Service were paid a total of \$375,252 from the appropriation increase of compensation, Department of Commerce, in addition to salaries paid from Lighthouse appropriations.

Medical treatment by the Public Health Service, without charge, was received by approximately 566 employees of the Lighthouse Service during the fiscal year for an aggregate of approximately 4,200 days.

Compensation for injuries under the employees' compensation law was received by some employees of the Lighthouse Service, and advantage was taken of the benefits of War Risk Insurance by some of the employees on vessels or at stations transferred to the Navy under the war emergency.

LIGHTHOUSE DEPOTS.

Construction of the lighthouse depot for the sixteenth district, at Ketchikan, Alaska, for which an appropriation of \$90,000 was made by act of July 1, 1918, was actively carried on during the year. On June 30, 1919, the wharf was about 95 per cent completed, and the entire work, including storehouse, shops, etc., about 35 per cent completed.

Important improvements are in progress at the General Lighthouse Depot, Tompkinsville, N. Y. The act of March 28, 1918, appropriated \$60,000 for repairs to the wharves. This work includes the removal of the old, wooden wharf decks and relaying them with reinforced concrete, with the installation of additional steelwork, cast-iron pile columns, manholes, etc. In order to permit use of the wharves while improvements are in progress, the work is being done in three sections, one at a time. The first section, the south wharf, was completed in February, 1919. It is expected that the second section will be completed about September, 1919, after which the remaining section will be taken up. The act of June 20, 1918, authorized \$65,000 for improving and extending the wharves at this depot, but no appropriation has been made. It is intended to extend the wharves eastward to the harbor line forming an outer basin, as the present inclosed basin is entirely too small to accommodate the vessels which now tie up there.

In August, 1918, the President approved and authorized an allotment of \$175,000 from the fund for the national security and defense for certain necessary improvements at the general lighthouse depot, consisting of the removal of certain buildings and the construction of a new boiler and plate shop, a new iron shed and racks, and a new coal pocket. The allotment also covers the machinery and equipment needed for these structures. The work is well under way, and the entire project will be completed about December 30, 1919.

The act of July 19, 1919, appropriated \$30,000 for extending and enlarging the machine shop at this depot, and plans are being prepared.

The act of June 12, 1917, appropriated \$21,000 for improving the office and laboratory at this depot. This work has been completed, except the installation of a heating system and other work of minor importance.

The act of July 1, 1918, appropriated \$85,000 for the construction of a depot for the second lighthouse district. A portion of the old marine-hospital property in Chelsea has been transferred as a site for this depot. The work is in progress, but the amount available is quite insufficient for the complete construction under existing conditions.

The act of June 20, 1918, authorized \$275,000 for improvements at the lighthouse depot at Portsmouth, Va., or establishing a new depot, but no appropriation has been made for this work. This is the principal depot of one of the largest lighthouse districts and is the headquarters for five tenders and two light vessels during the greater part of the year. The facilities for berthing these vessels are entirely inadequate, and the efficient operation of the vessels is much hampered in consequence. The inadequacy of space for storing and handling buoys also causes much delay and loss. Increased facilities for this depot are urgently necessary.

A new depot for the seventh lighthouse district, at Key West, Fla., is urgently needed for the efficient and economical handling of the work of the district. The present depot is located on property belonging to the Treasury Department, with naval coal sheds and piers on either side, where coal dust is practically always in motion and finds its way into the storehouse. The space allotted the Lighthouse Service for buoys and appendages is entirely inadequate, and the dock is often necessarily used by naval vessels, causing delays and hindering the work of lighthouse vessels. The depot consists of a wooden storehouse, which is built on a wooden pier. There is no oil house at this depot, due to lack of space, and kerosene, gasoline, and other inflammable supplies have to be kept in the storehouse, constituting a constant menace of fire.

Suitable depot facilities at Honolulu for the nineteenth lighthouse district are also much needed, and an estimate has been submitted for this purpose. The act of August 28, 1916, authorized this work in the amount of \$90,000, but no appropriation has been made.

The act of June 20, 1918, authorized \$88,500 for constructing a depot for the eighth lighthouse district at New Orleans, La., but no appropriation has been made therefor. A lighthouse depot at New Orleans, La., is of importance for the convenient and economical administration of the district, and estimate for appropriation has been submitted.

The new lighthouse depot at Charleston, S. C., for which an appropriation was made by the act of October 22, 1913, has been completed so far as funds permitted and was occupied regularly for the first time on August 1, 1916. Further improvements at Charleston Depot are needed, for which an estimate is submitted.

The act of July 1, 1918, appropriated \$53,000 for improvements at the Detroit Lighthouse Depot, Mich. Work on this project is in progress; it includes a concrete wharf to replace the present timber structure and the enlargement of the lamp shop and warehouse.

The amount appropriated will not be sufficient to complete these projects as planned, owing to the increased cost of materials and labor since the estimate was submitted. An additional estimate will be submitted to provide for completing the work as originally planned and for some further necessary improvements.

The present quarters at the Goat Island Lighthouse Depot, Cal., consist of two old frame dwellings, and are inadequate, unsanitary, and poorly arranged. An estimate is submitted for constructing two dwellings of modern design and proper location adjacent to the depot.

A new depot is greatly needed at Newport, R. I., or vicinity, and an estimate therefor has been submitted. The present depot for this locality is situated on the breakwater at Newport Harbor. This location is unsatisfactory and inconvenient, as the water at the dock is too shoal for the larger tenders, and there are no facilities for getting provisions, fresh water, ice, etc., causing much loss of time during working hours. The dock is in very bad condition, and the space for the Lighthouse Service is inadequate, due to extensions of operations by the Navy Department.

LIGHTHOUSE TENDERS.

The tenders of the Service have been employed to good advantage during the year. The 55 vessels which have been in commission have steamed a total of about 470,000 nautical miles in their work of supplying light vessels and light stations, maintaining the buoyage system, transporting construction materials, and carrying the officers and employees of the Service to their stations or on inspection duty, in addition to work performed in cooperation with other Government departments.

The tenders of this service have been more actively engaged during the past year than ever before. The Executive order transferring all tenders but one to the War and Navy Departments during the period of the war entailed additional and arduous duties on the vessels under these departments which resulted in serious handicaps in the carrying on of urgent work of this Service, which in many cases required simultaneous attention.

The tenders were in constant service, and due to their construction and equipment were well adapted to the work required by the other departments, particularly the Navy, and were selected for the establishment and maintenance of the submarine nets located at the entrances to the main ship channels of various ports. After the armistice was signed and hostilities ceased, the vessels were employed in the removal of miles of network which taxed them to their utmost, the work requiring the best of care and skill, but was accomplished satisfactorily and with dispatch.

An appropriation of \$20,000 was made by the act of July 1, 1916, for a light-draft tender and barge for use in establishing and maintaining aids along the intercoastal waterways of Texas and Louisiana. Proposals have been twice advertised for this equipment without satisfactory results. Plans and specifications have been prepared and bids are to be invited for a light-draft tender of special design for the shoal waters of the inland waterways. It is proposed to purchase or construct a working barge with pile driver and gear from the balance of the appropriation remaining.

With the increase in the number of aids to navigation and the deterioration of older vessels, it will be necessary to construct on an average of two new tenders each year. A full statement as to the need of vessels is given on pages 8 to 13. The act of June 12, 1917, appropriated \$150,000 to replace the tender *Gardenia*, which has been surveyed and laid up as being of no further use to the Service. Bids received for this work being greatly in excess of the appropriation were rejected.

Estimates have been submitted for new lighthouse tenders to replace the present tenders *John Rodgers*, *Jessamine*, and *Holly*, or for general service, as may be found most desirable. The vessels mentioned are all old, unseaworthy, sidewheel steamers, which should be laid up as soon as arrangements can be made. The act of June 20, 1918, authorized building three tenders and a light vessel, but no appropriation has been made.

The tender *Pine*, a small tender constructed for use along the inlets of the New Jersey coast, was completed and placed in commission on December 9, 1918. A description of this vessel is given on page 48.

The tender *Elm*, a working power barge for use on the Hudson River, was completed and placed in commission July 18, 1919. A description of this vessel is given on page 48.

Several small vessels no longer required by the Navy Department were examined by representatives of the Bureau with the view of the transfer to the Lighthouse Service of such as were suitable for lighthouse purposes. The 75-foot converted yacht *Elmasada* and the 50-foot converted passenger boat *Niagara*, both constructed of wood, and which are gasoline propelled, were accordingly transferred to the Lighthouse Service May 31 and June 4, 1919, respectively, and renamed *Cosmos* and *Poinsettia*. These small tenders are intended for use on lighthouse work in shoal and inland waters.

The tender *Gardenia*, which was surveyed, condemned, and laid up on March 1, 1917, being of no further use for lighthouse purposes, was transferred to the Navy Department for such temporary service as it could be used for during the period of the war. It was transferred back to the Lighthouse Service on July 28, 1919, and bids for its sale advertised to be opened August 14, 1919. No bids were received. The sale was readvertised and bids opened September 19, 1919. The highest bid received was \$1,065, which was accepted and the tender delivered to the purchaser.

The following tenders have either been extensively overhauled or such work has been started during the fiscal year 1919: *Arbutus*, *Hibiscus*, *Iris*, *Madrono*, *Maple*, *Mangrove*, *Magnolia*, *Marigold*, *Snowdrop*, and *Zizania*.

It is probable that during the current year extensive overhaul will be completed or undertaken on the following tenders: *Amaranth*, *Arbutus*, *Columbine*, *Dandelion*, *Hibiscus*, *Juniper*, *Manzanita*, *Madrono*, *Maple*, *Mangrove*, *Myrtle*, *Oleander*, *Orchid*, and *Sumac*.

The following was the number of tenders of the Lighthouse Service on June 30 of the years specified, omitting vessels not having regular crews and those less than 50 feet in length: 1910, 51; 1911, 46; 1912, 45; 1913, 44; 1914, 45; 1915, 46; 1916, 47; 1917, 51; 1918, 51; 1919, 55. On June 30, 1919, the following was the status of the tenders: In actual service, 52; undergoing repairs, 3.

LIGHT VESSELS.

The Lighthouse Service maintains light vessels on 50 stations and has for this purpose 65 light vessels, of which 13 are relief vessels. Some of these vessels are old, 3 having been built over 50 years ago; 8 having been built over 60 years ago; 1 is 70 years old. Some of the older vessels are in a condition which does not warrant extensive repairs.

On the afternoon of August 6, 1918, Diamond Shoal Light Vessel No. 71, N. C., was fired upon and sunk by an enemy submarine while moored on her station off Cape Hatteras, N. C. The 12 men on board the light vessel, consisting of 2 officers, 2 radio operators, and 8 crew, quickly took to one of the boats before the vessel sank and landed safely about 1 mile north of Cape Hatteras Lighthouse, but lost all of their belongings, which were left on board the light vessel.

Relief Light Vessel No. 51, stationed on Cornfield Point Light Vessel station, Conn., was collided with and sunk by a barge in tow of a Standard Oil tug on April 24, 1919. The light ship went down in eight minutes after being struck. Good judgment and discipline by officers and crew on the light vessel were shown in the emergency. No injury was sustained by any of the crew. The lifeboat and log and fog-signal books were the only property of the light vessel saved. This vessel was of iron, built in 1892. The owner of the tow has been called upon to indemnify the Government.

Bush Bluff Light Vessel No. 97 was surveyed, condemned, and recommended for sale by a board of survey on July 10, 1918, a careful examination of the vessel showing that it was of no further use to the Lighthouse Service, being beyond economical repair. The sale was widely advertised and bids invited to be opened March 20, 1919. No bids were received.

Thirty-Five Foot Channel Light Vessel No. 45, was surveyed, condemned, and recommended for sale by a board of survey on October 26, 1918. The vessel was partially destroyed by fire on March 3, 1918 and on close examination was found to be beyond economical repair. The vessel will be sold.

During the fiscal year 65 light vessels were in commission. New vessels under construction are light vessels No. 99 and No. 103, for duty on the Great Lakes.

The act of June 20, 1918, authorized \$760,000 for tenders and light vessels, which included a new light vessel for the Gulf coast, but no appropriation was made therefor. An estimate for this object is submitted.

The act of June 12, 1917, appropriated \$130,000 for a light vessel for Cape Charles, Va., or for general service, plans and specifications were completed and bids invited for the construction of the vessel. The lowest bid received was greatly in excess of the appropriation. No expenditures were made from this appropriation to June 20, 1919.

The following light vessels have either been extensively overhauled or such work has been started during the last fiscal year: No. 1, No. 13, No. 41, No. 49, No. 74, No. 81, No. 83, No. 88.

With the deterioration of the older light vessels now in service, it will be necessary to construct on an average of two new light vessels

each year. A full statement as to the need of vessels is made on pages 8 to 13.

It is probable that during the current fiscal year extensive overhaul will be completed or undertaken on the following light vessels: *No. 1, No. 5, No. 11, No. 34, No. 47, No. 56, No. 57, No. 66, No. 68.*

The following was the total number of light vessels and stations on June 30 of the years named:

Year.	Light vessels.	Light- vessel stations.	Year.	Light vessels.	Light- vessel stations.
1910.....	68	54	1915.....	66	53
1911.....	63	51	1916.....	66	53
1912.....	65	51	1917.....	68	53
1913.....	67	53	1918.....	67	52
1914.....	66	52	1919.....	65	50

Of the present light vessels, 36 have self-propelling machinery and 27 are provided with only sail power. Two have no means of propulsion.

† On June 30, 1919, the following was the status of the light vessels: Regular vessels on station, 45; relief vessels on station, 5; relief vessels at depots, 7; regular vessels under repair, 5; relief vessels under repair, 1; regular vessels laid up, 2; relief vessels laid up, 0.

REPORT OF OPEN-MARKET PURCHASES.

In compliance with the act of June 17, 1910, there is submitted separately as a part of this report a list of purchases of materials and supplies for the Lighthouse Service made without obtaining bids under public advertisement, with the reasons for so purchasing.

LEGISLATION ENACTED AFFECTING THE LIGHTHOUSE SERVICE.

The deficiency appropriation act of November 4, 1918, appropriated \$300,000 for repairing ice and storm damage on the Atlantic Coast; \$60,000 for purchase of additional gas buoys for improvement of aids to navigation, fifth lighthouse district; and \$80,000 for improving, repairing, establishing, and moving aids to navigation, St. Marys River, Mich., and vicinity.

The sundry civil act approved July 19, 1919, made the following appropriations: Execution Rocks Light Station, N. Y., restoring and improving the light station, \$10,000; Point Jiguero Light Station, P. R., rebuilding the station, \$24,000; Manitowoc Breakwater Light Station, Wis., improving the light and fog-signal station, \$9,000; Chicago Harbor Light Station, Ill., completing the removal and rebuilding of the light station and establishing lights on the new breakwater in Chicago Harbor, \$6,400; light-keepers' dwellings, for light keepers' dwellings and appurtenant structures, including sites therefor within the limit of cost fixed by the act approved February 26, 1907, \$50,000; Tompkinsville, Staten Island (N. Y.) Lighthouse Depot, extending and enlarging the machine shop, \$30,000; third lighthouse district, riprap to reinforce foundations of light stations and constructing or improving boat landings, \$150,000; Alaska, establishing new aids to navigation and improvements of existing aids, \$75,000.

The appropriations for the maintenance of the Lighthouse Service for the fiscal year 1920 are shown in tables on page 65.

The act of November 4, 1918, amended the retirement law affecting the field service to the extent that the provisions of this law do not apply to persons in the field service whose duties do not require substantially all their time.

The legislative act of March 1, 1919, provided for increased compensation during the fiscal year 1920 at the rate of \$240 per annum to all civilian employees of the Government, with certain exceptions, whose compensation does not exceed \$2,500 per annum, in lieu of the \$120 per annum increase in force during the preceding fiscal year, but as a provision of the law excluded employees whose duties require only a portion of their time, a considerable number of lighthouse employees were affected and suffered what amounted to a virtual reduction in pay at a very inopportune time.

The following works were authorized by the act of June 20, 1918, at the limits of cost specified, but except St. Marys River, have not yet been appropriated for. Constructing or purchasing and equipping lighthouse tenders and light vessels to replace vessels worn out in service in the third, fifth, and eighth lighthouse districts, or for use in the Lighthouse Service generally, \$760,000; enlarging and improving the lighthouse depot at Portsmouth, Va., in the fifth lighthouse district, or establishing a new depot, \$275,000; improving, repairing, establishing, and moving aids to navigation in St. Marys River, Mich., and vicinity, \$80,000; extending and enlarging the machine shop at the general lighthouse depot, Tompkinsville, Staten Island, N. Y., \$30,000; establishing and improving aids to navigation in the Virgin Islands of the United States and adjacent waters, West Indies, \$50,000; improving and extending the wharves at the General Lighthouse Depot, Tompkinsville, Staten Island, N. Y., \$65,000; improving the aids to navigation and installing new aids in the Potomac River, Md. and Va., \$95,000; constructing and equipping a lighthouse depot for the eighth lighthouse district at New Orleans, La., or vicinity, \$88,500. Estimates for these items have been submitted, some at an increased cost due to increased prices since originally submitted.

SPECIAL LEGISLATION NEEDED.

The act of August 29, 1916, authorizing the President to transfer to the Navy or War Department portions of the Lighthouse Service when there is a national emergency should be amended so as to definitely define the status of the personnel transferred. All persons so transferred who serve on vessels or at stations where they are exposed to the risks of war should have a suitable military status and be entitled to all relief provided by legislation for those in the military services. Particularly the officers of vessels of the Lighthouse Service, frequently called upon to cooperate with vessels of the Navy, should have suitable military standing. Although the personnel transferred were, under rulings of the Treasury Department, given the benefits of the War Risk Insurance, there was considerable conflict in decisions as to their standing under the act of August 29, 1916. All of the personnel were in an indefinite and anomalous position in their relations with the military and naval personnel. Specific recommendation is deferred until conditions become more settled after the war.

In any future transfer of vessels there should, if practicable, be more definite understanding as to the extent to which tenders are to be diverted from their lighthouse duty. The upkeep of the system of aids to navigation requires every effort of the present equipment of tenders, and their efficient maintenance is even more important in time of war than in normal times.

Legislation is recommended to cover adjustment of claims by lighthouse employees for loss of or damage to personal property, such as clothing, furniture, etc., caused by storms, tidal waves, collisions, or fire at light stations, depots, and on vessels. Such provision should be made in justice to these employees engaged on hazardous duty. By act of June 17, 1910, it was provided that claims against the Government for damages not exceeding \$500 arising out of collisions for which lighthouse vessels are responsible be determined and settled by the Commissioner of Lighthouses. This provision has worked satisfactorily, enabling the Government to adjust claims promptly and relieving Congress of the annoyance of many petty claims; and similar legislation covering losses of personal property by lighthouse employees under the circumstances referred to would be advantageous to the Government and result in more equal justice to employees. Light stations are for the most part situated at remote, isolated points where in case of severe storm, tidal wave, fire, or other calamity it is difficult or impossible to obtain assistance for the saving of property. The light keepers in such emergencies, faithful to their duties and to the call of humanity, invariably have devoted themselves to the maintenance of the lights, the saving of public property, or to the protection or rescue of human life. As a result their own property has sometimes been destroyed or seriously damaged. This may represent the accumulations of a lifetime and a serious loss. The furnishings and equipment of light stations provided by the Government are designed only for actual necessities for the performance of a keeper's duties, and keepers must necessarily have personal property at the station. Similar conditions exist with reference to men on lighthouse vessels, though the personal property in such cases is generally confined to wearing apparel. The number of such cases has not been great, and the quantity of general relief by legislation would not involve the Government in any great expenditure. Congress has in the past occasionally passed special legislation reimbursing employees of the Lighthouse Service for their personal property lost or destroyed, but the process of securing such legislation is slow and in the majority of cases has failed, and the present lack of system consequently results in very unequal justice. The conditions and limitations proposed are practically the same as those which Congress has already provided by law for reimbursement for losses sustained by men in the military service (Mar. 3, 1885; 23 Stat., 350) and in the naval service (Mar. 2, 1895; 28 Stat., 962).

Legislation is recommended authorizing the establishment and maintenance of post-lantern lights and other aids to navigation of the Yukon River and its tributaries, Alaska. The waters of the Yukon delta are already being marked, but Congressional authority is required for the Lighthouse Service to extend its jurisdiction to the nontidal waters of these rivers. Navigation of the Yukon River is increasing and as it is navigable for a long distance many lights and day marks are required to safeguard shipping.

Legislation is also recommended providing for medical relief for lighthouse keepers, without charge, at other than hospitals and stations of the Public Health Service. The act of August 28, 1916 (39 Stat., 538), provided for medical relief without charge for light keepers and assistant light keepers of the Lighthouse Service at hospitals and stations of the Public Health Service under the rules and regulations governing the care of seamen of the merchant marine. The hospitals and stations of the Public Health Service are for the most part located at the principal ports, and while convenient for the use of seamen are inaccessible for a large number of lighthouse keepers who are stationed at remote and isolated points. Many keepers are, therefore, unable to avail themselves of the benefits of the legislation heretofore enacted. The Secretary of the Treasury in a letter of May 28, 1919, to the Secretary of Commerce concurred in the recommendation for such legislation.

The act of June 20, 1918, providing for voluntary retirement at the age of 65 after 30 years' service, and compulsory retirement at the age of 70, for certain classes of employees of the Lighthouse Service has proved beneficial both to the men eligible to retirement and to the Service in replacing such men with younger and more capable employees. Still greater efficiency, however, will result, and hardship to deserving employees will be avoided if the same benefits are extended to persons who become disabled from efficiently performing their duties by reason of disability incident to their work, such disability being distinct from that caused by injury received in the line of duty, for which compensation is now provided by law, and legislation to this end is recommended.

The officers of the Lighthouse Service are strongly of the opinion that the interests of the Government would be further benefited, in the attainment of a higher degree of efficiency, as well as in affording justice to deserving employees, by the enactment of legislation providing for a system of general retirement for the civil employees of the Government, including office and shop employees of the Lighthouse Service, the need of such legislation being particularly apparent in the work of this Service.

The statistics as to the various classes of aids to navigation and fuller details on many of the subjects mentioned in this report will be found in the pages following.

Respectfully,

GEORGE R. PUTNAM,
Commissioner of Lighthouses.

To Hon. WILLIAM C. REDFIELD,
Secretary of Commerce.

STATISTICS AND ESTIMATES.

LIST OF OFFICERS OF THE BUREAU OF LIGHTHOUSES AND THE LIGHTHOUSE DISTRICTS.

OFFICERS OF THE BUREAU OF LIGHTHOUSES ON JUNE 30, 1919.

George R. Putnam.....Commissioner of Lighthouses.
 John S. Conway.....Deputy Commissioner.
 H. B. Bowerman.....Chief Constructing Engineer.
 Edward C. Gillette.....Superintendent of Naval Construction.

Principal Assistant Engineer, Rudolph Zirpel.
 Superintendent on general duty, E. M. Trott.
 Chief Clerk, Thaddeus S. Clark.
 Examiner, Thomas Flood.

SUPERINTENDENTS OF LIGHTHOUSE DISTRICTS JULY 1, 1918, TO JUNE 30, 1919.

District.	Name.	From—	To—
1st.....	C. E. Sherman.....	July 17, 1911	
2d.....	R. H. Goddard.....	June 27, 1912	Mat. 4, 1919
	G. E. Eaton.....	Mar. 7, 1919	
3d.....	J. T. Yates.....	June 20, 1912	
4th.....	T. J. Rout.....	Mar. 1, 1912	
5th.....	H. D. King.....	Jan. 28, 1915	
6th.....	H. L. Beck.....	Jan. 28, 1915	
7th.....	W. W. Demeritt.....	Aug. 22, 1913	
8th.....	B. B. Dorry.....	June 6, 1912	
9th.....	F. C. Hingsburg.....	Jan. 28, 1918	
10th.....	Roscoe House.....	June 4, 1912	
11th.....	E. L. Woodruff.....	Aug. 19, 1912	
12th.....	C. H. Hubbard.....	May 1, 1918	
13th.....	Maj. Gen. A. Mackenzie, U. S. Army, retired.....	May 20, 1917	June 8, 1919
	Col. H. Burgess, Corps of Engineers, U. S. Army.....	June 9, 1919	
14th.....	Col. Lansing H. Beach, Corps of Engineers, U. S. Army.....	Aug. 10, 1915	
15th.....	Brig. Gen. Win. H. Bixby, U. S. Army, retired.....	Sept. 17, 1917	Jan. 31, 1919
	Col. C. McD. Townsend, Corps of Engineers, U. S. Army.....	Feb. 1, 1919	
16th.....	W. C. Dibrell.....	Aug. 22, 1913	
17th.....	Robert Warrack.....	Feb. 1, 1915	
18th.....	H. W. Rhodes.....	July 6, 1912	
19th.....	A. E. Arledge.....	Sept. 3, 1912	

JURISDICTION OF LIGHTHOUSE SERVICE.

The United States Lighthouse Service is charged with the establishment and maintenance of aids to navigation and with all equipment and work incident thereto on the sea and lake coasts of the United States, on the rivers of the United States so far as specifically authorized by law, and on the coasts of all other territory under the jurisdiction of the United States, with the exception of the Philippine Islands and Panama. The total length of coast line and rivers under the United States Lighthouse Service, measured by steps of 3 miles, is approximately 47,300 miles.

LIMITS OF LIGHTHOUSE DISTRICTS AND ADDRESSES OF SUPERINTENDENTS OF LIGHTHOUSES.

District.	Limits of district.	Address of superintendents.
1st.....	Waters of Maine and New Hampshire.....	Y. M. C. A. Building, Portland, Me.
2d.....	Waters of Massachusetts.....	Customhouse, Boston, Mass.
3d.....	Waters of Rhode Island, Connecticut, New York, and New Jersey northward of Cape May.	Tompkinsville, N. Y.
4th.....	Waters of Delaware seacoast and Delaware Bay and River.	Post Office Building, Philadelphia, Pa.
5th.....	Waters of Maryland, Virginia, and North Carolina to and including New River Inlet, N. C.	New Customhouse, Baltimore, Md.
6th.....	From New River Inlet, N. C., to Hillsboro Inlet, Fla.	Old Post Office Building, Charleston, S. C.
7th.....	Waters of Florida from Hillsboro Inlet to Cedar Keys.	Key West, Fla.
8th.....	Waters of Gulf Coast from Cedar Keys, Fla., to mouth of Rio Grande, Tex., and Mississippi River below New Orleans.	Customhouse, New Orleans, La.
9th.....	Waters of Porto Rico and adjacent United States islands.	San Juan, P. R.
10th.....	United States waters of St. Lawrence River and Lakes Ontario and Erie.	Federal Building, Buffalo, N. Y.
11th.....	United States waters of Lakes St. Clair, Huron, and Superior, and Detroit River.	Post Office Building, Detroit, Mich.
12th.....	Waters of Lake Michigan and Green Bay.....	Federal Building, Milwaukee, Wis.
13th.....	Mississippi River above the mouth of the Missouri River, Minnesota, Illinois, Osage, Gasconade, and Missouri Rivers.	Federal Building, Rock Island, Ill.
14th.....	Ohio, Tennessee, Kanawha, and Monongahela Rivers.	Customhouse, Cincinnati, Ohio.
15th.....	Mississippi River below the Missouri River to New Orleans, La., and Red River.	Customhouse, St. Louis, Mo.
16th.....	Waters of Alaska.....	Ketchikan, Alaska.
17th.....	Waters of Washington and Oregon.....	Customhouse, Portland, Oreg.
18th.....	Waters of California.....	Customhouse, San Francisco, Calif.
19th.....	Waters of Hawaiian, Midway, Guam, and American Samoan Islands.	McCandless Building, Honolulu, Hawaii.

LIGHTHOUSE DEPOTS MAINTAINED ON JUNE 30, 1919.

[The principal depot of the district is indicated by the larger type.]

District.	Location.	District.	Location.
1st.....	Bear Island, Me.	8th.....	Fort San Jacinto, Galveston, Tex.
	LITTLE DIAMOND ISLAND, ME.		Mobile, Ala.
2d.....	LOVELLS ISLAND, BOSTON, MASS.		PORT EADS, LA.
	Woods Hole, Mass.		
3d.....	Atlantic City, N. J.	9th.....	SAN JUAN, P. R.
	Goat Island, R. I.	10th.....	BUFFALO, N. Y.
	Juniper Island, Vt.		Erie, Pa.
	New London, Conn.		Maumee Bay, Ohio.
	TOMPKINSVILLE, STATEN ISLAND, N. Y.		Rock Island, N. Y.
4th.....	Tucker Beach, N. J.		Sandusky Bay (Cedar Point), Ohio.
	EDGEMOOR, DEL.	11th.....	DETROIT, MICH.
	Lewes, Del.		Minnesota Point, Minn.
5th.....	Annapolis, Md.		St. Marys River, Mich.
	Lazaretto Point, Md.	12th.....	Charlevoix, Mich.
	Point Lookout, Md.		MILWAUKEE, WIS.
	PORTSMOUTH, VA.	16th.....	KETCHIKAN, ALASKA.
	Washington Wharf, D. C.	17th.....	Ediz Hook, Wash.
	Washington, N. C.		TONGUE POINT, OREG.
6th.....	CHARLESTON, S. C.	18th.....	GOAT ISLAND, CALIF.
7th.....	Egmont Key, Fla.	19th.....	HONOLULU, HAWAII.
	KEY WEST, FLA.		

EXPLANATION OF TABLE ON PAGE 35.

The table of aids to navigation includes all those maintained by the Lighthouse Service, a total of 16,075. On page 43 are given facts regarding the private aids to navigation, 786 in number, maintained under authority. In the statistics relief light vessels are not counted and duplicate or auxiliary lights and fog signals are not counted, but double lights are counted separately when maintained on distinct structures or for distinct purposes. Buoys for the purpose of marking the positions of light vessels or larger buoys are not counted. Fog signals at light stations or on vessels are counted as separate aids, but not those attached to buoys, except in the case of submarine bells, which are counted as separate signals, whether on vessels or on buoys. Otherwise each buoy is counted only once, and if it is included in a higher class it is not in the lower class. Light-vessel lights are not counted separately.

[See note on p. 33.]

AIDS TO NAVIGATION MAINTAINED.

35

Class.	1st dist.	2d dist.	3d dist.	4th dist.	5th dist.	6th dist.	7th dist.	8th dist.	9th dist.	10th dist.	11th dist.	12th dist.	13th dist.	14th dist.	15th dist.	16th dist.	17th dist.	18th dist.	19th dist.	Total.
LIGHTED AIDS.																				
Hyper-radiant lights.....																				1
First-order lights.....	2	5	5	2	8	8	6	3									9		1	57
Second-order lights.....	7	3	2		2	2	1	2	1			3					1		2	26
Third-order lights.....	6	1	3	2		3	4	8	6			10				4	2	4	1	67
Three-and-one-half-order lights.....		2	1	3	1	1		3	1	3	6	2							1	24
Fourth-order lights.....	35	25	58	9	49	2	4	12	4	22	47	37				5	19	20	9	357
Fifth-order lights.....	18	15	18	4	21	3	1	13	3	10	14	12						2		134
Sixth-order lights.....	1	5	22	2	8				5	8	4	16								71
Range-lens lights.....			9	14	5	9				6	3						2			48
Reflector lights.....	2	7	1	12	17	37	13	8	2	6	27	4					2			138
Lens-lantern lights.....	12	27	59	21	46	64	38	157	21	39	91	48				101	29	38		829
Minor lights.....	3	18	171	27	298	178	76	109	2	1	84	7	457	569	766	64	286	14	2	3,132
Electric lights without lens.....	1															1	3	2	2	16
Light-vessel stations.....	1	11	10		6	4		2			5	6					3	2		50
Gas-lighted buoys.....	4	39	51	11	64	8	6	23	5	32	78	16				5	11	8	6	367
Gas and whistling buoys.....	7	6	11		11	8	5	9	1			1				1	6	8		74
Gas and aerial bell buoys.....		9	20	7	18	8	7	2		2	11	14				2	5	6	1	112
Float lights.....									1	22	5	5	83	40		5	1			162
Total.....	99	173	441	114	552	335	161	351	54	155	388	179	540	609	766	188	383	114	63	5,665
Lights on fixed aids.....	87	108	349	96	453	307	143	315	47	99	289	137	457	569	766	175	357	90	56	4,900
Lights on floating aids.....	12	65	92	18	99	28	18	36	7	56	99	42	83	40		13	26	24	7	765
Total lighted aids.....	99	173	441	114	552	335	161	351	54	155	388	179	540	609	766	188	383	114	63	5,665
UNLIGHTED AIDS.																				
Fog signals, engine power.....	19	21	37	5	14	4		3		11	39	47				10	26	30		266
Fog signals, clock power.....	37	13	59	6	63	3	1	14		5	5	9				1	4	6		226
Fog signals, hand power.....	12	1	2								1	1								17
Fog signals, electric.....		5	4	1	4						6						1	4		25
Submarine signals.....	2	8	9		7	5		2			5	4				1	4	2		49
Buoys, whistling (unlighted).....	19	10	8		2	6	3	5	1								7	18		79
Buoys, bell (unlighted).....	53	37	57		28	7	8	15	4	1	1	3				3	8	15		245
Buoys, iron.....	149	64	155	108	263	288	216	169	133	10	26	29				164	130	56	60	2,020
Buoys, spar (wood).....	704	620	901	93	982	6		178		158	489	139	553			44	131	30	7	5,035
Daymarks, beacons, etc.....	177	75	36	1	374	545	344	247	6		4	8	357	60		64	78	31	41	2,448
Total unlighted aids.....	1,172	854	1,908	219	1,737	864	572	633	144	185	576	240	910	60		287	389	192	108	10,410
Grand total.....	1,271	1,027	1,709	333	2,289	1,199	733	984	198	340	964	419	1,450	669	766	475	772	306	171	16,075

DETAILS AS TO CHARACTERISTICS OF LIGHTS (NOT INCLUDING LIGHT VESSELS).^a

	1st dist.	2d dist.	3d dist.	4th dist.	5th dist.	6th dist.	7th dist.	8th dist.	9th dist.	10th dist.	11th dist.	12th dist.	16th dist.	17th dist.	18th dist.	19th dist.	Total.
Fixed white:																	
Sixth order and above..	31	30	52	16	60	25	4	28	7	22	29	23	1	3	2	4	337
Below the sixth order...	1	10	83	9	229	139	55	138	3	5	63	6	48	204	18	11	1,022
Lighted buoys.....			5					1		10	2	5	1				24
Fixed red:																	
Sixth order and above..	14	10	22	2	20	20	9	8	3	15	34	27		3		3	90
Below the sixth order...	5	13	119	9	92	78	37	112	10	15	64	16	5	93	23	9	700
Lighted buoys.....		2	7						1	12	3		4	1			30
Fixed green:																	
Below the sixth order...									1								1
Flashing or occulting:																	
Sixth order and above..	15	17	40	30	26	17	15	10	10	20	41	18	8	25	34	7	333
Below the sixth order...	9	23	28	30	21	25	22	16	13	20	48	33	113	26	13	22	463
Lighted buoys.....	11	52	70	18	93	24	18	33	6	34	89	31	8	22	22	7	538
Fixed and flashing, sixth order and above.....	12	6	5		3	3	1	3	2	2	10	14		3			64
Candlepower:																	
50,000 to 190,000.....	5	4	4	7	4	7	5	5	3	4	7	1	1	2	9	1	60
200,000 to 490,000.....		1	2	1	1	1	1	1			3	1	1	1	2	1	17
500,000 and over.....		1	1													1	3
Twin light stations.....	2	3															5
Stations with resident keepers.....	70	47	112	30	88	22	12	50	21	35	74	66	10	35	38	14	724

DETAILS AS TO ILLUMINANTS OF LIGHTS (NOT INCLUDING LIGHT VESSELS).^a

	1st dist.	2d dist.	3d dist.	4th dist.	5th dist.	6th dist.	7th dist.	8th dist.	9th dist.	10th dist.	11th dist.	12th dist.	16th dist.	17th dist.	18th dist.	19th dist.	Total.
Incandescent oil vapor.....	28	25	39	18	10	15	11	13	11	9	10	12	3	26	27	6	318
Oil (wick lamps):																	
Sixth order and above..	43	31	78	6	72	40	12	25	10	36	42	41	3	2	2	7	454
Below the sixth order...	6	15	188	16	303	217	92	223	10	19	101	19	52	81	36	14	1,592
Lighted buoys.....									1	22	5	5	5	1			39
Acetylene:																	
Sixth order and above..		2	1	15	9	10	4	7	1	8	13	4	3	2	1	1	81
Below the sixth order...	9	22	38	27	23	25	22	43	7	18	27	33	113	17	11	22	457
Lighted buoys.....	6	28	33	6	50	24	15	9			23	7	8	17	10	7	243
Oil gas:																	
Lights with mantles.....					1				1		50						52
Lights without mantles.....			1		15				1		1						18
Lighted buoys with mantles.....	1		13	2	32			2	2	34	66	22		5	7		186
Lighted buoys without mantles.....	4	26	36	10	11		3	23	4			2			5		124
Electric arc:																	
Sixth order and above..															1		1
Below the sixth order...														2			2
Electric incandescent:																	
Sixth order and above..	1	3	1	9	8		2			6	12	7		4	5		58
Below the sixth order...		8	3	5	3				8	3	4	3	1	23	7	6	74
Gas (coal), sixth order and above.....		2										1					3

^a Does not include the thirteenth, fourteenth, and fifteenth lighthouse (river) districts, in which there are 1,792 lights on fixed aids and 123 lights on floating aids, all of which use kerosene and are fixed, except in 4, which use acetylene and are flashing, and 1 which uses electricity.

DETAILS AS TO LIGHTS ON LIGHT VESSELS.

	1st dist.	2d dist.	3d dist.	5th dist.	6th dist.	8th dist.	11th dist.	12th dist.	17th dist.	18th dist.	Total.
Characteristics as to lights:											
1 fixed white light.....		3	1		1		4	4			13
2 fixed white lights.....		1	3	1		1			2	1	9
1 fixed red light.....								1			1
2 fixed red lights.....		2									2
1 fixed white and 1 fixed red light.....		1			1				1		3
1 white flashing, or occulting, and 1 fixed red light.....			2								2
1 white light, flashing or occulting.....	1	4	4	4	2	1	1	1		1	19
2 white lights, flashing or occulting.....				1							1
Illuminants:											
Incandescent oil vapor.....		1			1	1					3
Acetylene.....	1	3	5	4	2						15
Oil (wick).....		6	3	1	1	1	4	5	3	1	23
Oil (wick) and acetylene.....			1								1
Electric arc.....			1								1
Electric incandescent.....		1		1			1	1		1	5
Illuminating apparatus:											
Fourth order.....		1		1	1	1		1			5
Reflector.....		2	3	1	1		2		1		10
Reflector and lens lantern.....			2								2
Lens lantern.....	1	8	5	4	2	1	3	5	2	2	33

DETAILS AS TO FOG SIGNALS.

Kind and how operated.	1st dist.	2d dist.	3d dist.	4th dist.	5th dist.	6th dist.	7th dist.	8th dist.	10th dist.	11th dist.	12th dist.	16th dist.	17th dist.	18th dist.	Total.
Steam:															
Whistle.....	8	5	6		4	2		1	3	30	31		3	5	98
Siren.....			1										1	1	3
Air:															
Whistle.....	1	4									5				10
Siren.....	2	4	23	1	5	1		1	3	7	9	5	6	15	82
Diaphone.....		1			1	1			5	2	2	1	2	9	24
Siren (electric).....				1	1					3			1	4	10
Reed horn.....	8	6	7	4	4			1				4	14		48
Submarine bells:															
On light vessels, driven by compressed air.....	1	7	7		6	3		2		3	4		3	2	38
On bottom, electric power.....										2					2
On buoys, operated by sea.....	1	1	2		1	2						1	1		9
Bell:															
Clockwork.....	37	13	59	6	63	3	1	14	5	5	9	1	3	6	225
Electric.....		5	4		2					3			1		16
Engine.....		1													1
Hand.....	12	1	2												15
Horn: Hand.....										1	1				2
Total.....	70	48	111	12	88	12	1	19	16	56	61	12	35	42	a 583

a Auxiliary fog signals (71), whistling buoys (153), and bell buoys (357) are not included.

LIGHTS WHERE ILLUMINATION WAS IMPROVED DURING THE FISCAL YEAR 1919.

FLASHING OR OCCULTING LIGHTS CHANGED FROM FIXED LIGHTS (20 LIGHTS).

District.	Location.	District.	Location.
2d.....	Egg Rock, Mass.	12th.....	Chicago Harbor Breakwater, North-west End, Ill.
5th.....	Cape Charles City Range Front, Va.	16th.....	Beck Island, Clarence Strait, Alaska.
	Cape Lookout Shoals Light Vessel No. 80, N. C.		Fire Island, Cook Inlet, Alaska.
	Fenwick Island Shoal Light Vessel No. 52, Del.		Port Walter, Chatham Strait, Alaska.
6th.....	Havre de Grace, Md.		Skin Island, Clarence Strait, Alaska.
11th.....	Wappoo Cut Light No. 1, S. C.		Tree Point, Revillagigedo Channel, Alaska.
	Clinton River Range (2 lights), Mich.	17th.....	Minor Island, Juan de Fuca Strait, Wash.
	Copper Harbor, Mich.		Robinson Point, Puget Sound, Wash.
	Pilot Island Range Front, Mich.	18th.....	San Pedro Entrance, No. 2, Calif.
	Sand Hills, Mich.		

INCANDESCENT OIL-VAPOR LIGHTS CHANGED FROM OIL-WICK LIGHTS (3 LIGHTS).

10th.....	Lorain West Breakwater Pierhead, Ohio (from acetylene).	11th.....	Sand Hills, Mich.
		16th.....	Tree Point, Revillagigedo Channel, Alaska.
		17th.....	Lime Kiln, Wash. (from acetylene).

ACETYLENE OR OTHER LIGHTS CHANGED FROM OIL-WICK LIGHTS, ETC. (37 LIGHTS).

2d.....	Egg Rock, Mass.	9th.....	Point Borinquen, P. R. (oil gas from l. o. v.).
	Fort Pickering, Mass. (electric incandescent).	11th.....	Chicago Outer Breakwater Northwest End, Ill. (from oil gas).
	Nobska Point, Vineyard Sound, Mass. (electric incandescent from l. o. v.).		Clinton River Range, (2 lights), Mich.
3d.....	Bartlett Reef Light Vessel No. 13, Conn.		Pilot Island Range (2 lights), Mich.
	Craven Shoal Gas and Bell Buoy, N. Y. (from oil gas).		Sheboygan Breakwater, Wis. (electric incandescent).
	Fire Island Light Vessel No. 68, N. Y. (from electric incandescent).	16th.....	White River, Mich. (electric incandescent).
	Overfalls Light Vessel No. 69, N. J. (from electric incandescent).		Akutan, Unimak Pass, Alaska.
	Scotland Light Vessel No. 11, N. J. (from oil and oil gas).		Beck Island, Clarence Strait, Alaska.
4th.....	Baker Range Rear, Del.		Fire Island, Cook Inlet, Alaska.
	Bellevue Range Rear, Del. (from l. o. v.).	17th.....	Port Walter, Chatham Strait, Alaska.
	Horseshoe Range West Group Rear, Pa. (electric incandescent).		Skin Island, Clarence Strait, Alaska.
5th.....	Cape Lookout Shoals Light Vessel No. 80, N. C.		Alki Point, Puget Sound, Wash. (electric incandescent from l. o. v.).
	Havre de Grace, Md.		Minor Island, Juan de Fuca Strait, Wash.
	Kettle Bottom Shoals Upper, Md. (from oil gas).		Point Roberts, Haro Strait, Wash.
6th.....	Wappoo Cut, S. C.		Robinson Point, Puget Sound, Wash. (electric incandescent from l. o. v.).
8th.....	South Pass West Jetty Range Rear, Mississippi River, La.	18th.....	San Pedro Entrance, No. 2, Calif.
			Point Mentara, Calif. (electric incandescent from l. o. v.).
			Point Pines, Calif. (electric incandescent from l. o. v.).

LIGHTS DISCONTINUED DURING THE FISCAL YEAR 1918.

[60 lights, including float lights.]

District.	Location.	Order.
3d.....	Barge Wreck 7, Upper Bay, N. Y.....	Minor (oil gas).
	Edwin R. Kirk Wreck, Upper Bay, N. Y.....	Lens lantern (oil gas).
	Rudolph Bros. Wreck, Hudson River, N. Y.....	Minor (oil gas).
4th.....	Delaware Breakwater Range Rear, Delaware Bay, Del.....	3d.
5th.....	Dutch Gap (2 lights), James River, Va.....	Minor.
	Curtis Bay, Patuxent River, Md.....	Do.
	Manokin River, Md.....	Minor (acetylene).
	North River, N. C.....	5th.
	St. Pierre Island, Manokin River, Md.....	Minor (acetylene).
6th.....	Dame Point Dredged Cut, St. Johns River, Fla.....	Do.
	Dunn Creek Range (2 lights), St. Johns River, Fla.....	Lens lantern.
	Sleep Bank, St. Johns River, Fla.....	Minor.
10th.....	Tempest Wreck (2 lights), Erie Harbor, Lake Erie, Pa.....	Do.
12th.....	Racine Breakwater, Wis.....	Lens lantern.
	St. Joseph, Mich.....	4th.
	Saugatuck North Pierhead, East Shore, Lake Michigan, Mich.....	Lens lantern.
13th.....	8 lights.....	Minor.
	1 lighted spar.....	Do.
14th.....	6 lights.....	Do.
15th.....	17 lights.....	Do.
17th.....	Coquille Point, Yaquina Bay, Oreg.....	Do.
18th.....	Dredmen's Island Breakwater, Los Angeles Harbor, Calif.....	Lens lantern.
	Hookton Channel Range Rear, Humboldt Bay, Calif.....	Minor.
	San Diego Bay (5 lights), Calif.....	{ Lens lantern (1) (acetylene).
	San Pedro Harbor, Calif.....	{ Minor (4).
		Lens lantern.

GAS BUOYS ESTABLISHED AND DISCONTINUED DURING THE FISCAL YEAR 1919.

District.	Location.	District.	Location.
	ESTABLISHED (73).	4th.....	Artificial Island, Delaware River, N. J.
2d.....	Cape Ann (whistling), Mass.		Scully Wreck (bell), Delaware Bay, Del.
	Governor Powers Wreck, (bell), Nantucket Sound, Mass.	5th.....	Bush Bluff (bell), Elizabeth River, Va.
	Lansford Wreck, Cape Cod, Mass.		Dredge Wreck (bell), Elizabeth River, Va.
	Mary Ann Rocks, Cape Cod, Mass.		Guinea Marshes, 2A (bell), York River, Va.
	Metropolitan, Boston Harbor, Mass.		Newport News North Channel (2), Va.
3d.....	South Channel, Boston Harbor, Mass.		North River Entrance (bell), Pamlico Sound, N. C.
	Almirante Wreck, Seacoast, N. J.		Rappahannock Spit, Chesapeake Bay, Va.
	Barge 7 Wreck, Upper Bay, N. Y.		Scow Wreck, Elizabeth River, Va.
	Common Fence Point Shoal, Mount Hope Bay, R. I.		Six-Fathom, Seacoast, Md.
	Cow and Calf, Long Island Sound, Conn.		Tangier Sound Entrance, Va.
	Craven Shoal, (bell), Lower Bay, N. Y.		Thimble Shoal Dredged Channel (4), Hampton Roads, Va.
	Dyer Island North Point Shoal (2-1 bell) Narragansett Bay, Eastern Passage, R. I.		29-Foot Lump (bell), Chesapeake Bay, Va.
	Edwin R. Kirk, Upper Bay, N. Y.		30-Foot Spot, 8B, Chesapeake Bay, Va.
	Hog Neck, Peconic Bay, N. Y.		Wolf Trap (bell), Chesapeake Bay, Va.
	Hallocks Point Shoal, Peconic Bay, N. Y.		York River (bell), Va.
	Hen and Chickens Northeast, Long Island Sound, N. Y.		30-Foot Curve (bell), Chesapeake Bay, Va.
	Jessup Neck Shoal, Peconic Bay, N. Y.		Fenwick Island Shoal, 1FIS (whistling), Del.
	Marietta Wreck, Long Island Sound, Conn.	6th.....	Commodore Point Shoal, St. Johns River, Fla.
	Northport Bay Entrance, Long Island Sound, N. Y.		Drum Island, Charleston Harbor, S. C.
	Obstruction, off Fire Island, N. Y.		Jupiter, Seacoast (bell), Fla.
	Port Phillip Wreck, Lower Bay, N. Y.		Middle Ground (bell), St. Johns River, Fla.
	Parsonage Point, Long Island Sound, N. Y.		Steel Pontoon Wreck, St. Simon Sound, Ga.
	Patience Island (bell), Narragansett Bay, R. I.		Miami Entrance, Fla.
	Sweet Channel, Lower Bay, N. Y.	7th.....	Sand Key Ridge West End (bell), Florida Reefs, Fla.
	Serantes Wreck, Upper Bay, N. Y.		Southwest Pass Entrance (whistling), La.
	Steamer Wreck, Seacoast, N. J.	5th.....	
	Schooner Wreck, Seacoast, N. J.		
	San Saba Wreck, Seacoast, N. J.		
	West Neck, Peconic Bay, N. Y.		

GAS BUOYS ESTABLISHED AND DISCONTINUED DURING THE FISCAL YEAR 1919—
Continued.

District.	Location.	District.	Location.
10th.....	Buffalo Approach, Lake Erie, East End, N. Y.	3d.....	Rockaway Point, Rockaway Inlet, N. Y.
	North Entrance (2), Buffalo Harbor, N. Y.		San Baba Wreck, Seacoast, N. J.
	Scott Point, Lake Erie, Ohio.		Steamer Wreck, Seacoast, N. J.
11th.....	Belle Isle East End, Mich.		Swept Channel, Lower Bay, N. Y.
	Marquette Breakwater, 2a, Mich.		West Neck, Shelter Island Sound, N. Y.
	W. R. Linn Wreck, Lake Huron, South End, Mich.	4th.....	Baker Range, Delaware River, Del.
12th.....	Desmond Wreck (bell), Calumet Harbor, Ill.		Marcus Hook Range, Delaware River, N. J.
	Racine North Breakwater, Wis.	5th.....	Derrick Wreck, Elizabeth River, Va.
	Sturgeon Bay Entrance, Wis.		Dredge Wreck, Elizabeth River, Va.
16th.....	Morris Reef (bell), Alaska.		Elbow of York Spit (bell), Va.
18th.....	Crescent City Entrance (bell), Calif.		Fenwick Island Shoal, 4 F.I.S. (whistling), Del.
	North Channel, San Francisco Bay, Calif.		Georgia Wreck, Seacoast, Va.
	DISCONTINUED (80).		Guinea Marshes, 2A (bell), York River, Va.
1st.....	Halibut Hole, Frenchman Bay, Me.		Haubage Wreck, Seacoast, Va.
	25-Foot Shoal, West Penobscot Bay, Me.		Lynn Haven Roads, 3, Va.
2d.....	Great Ledge, Woods Hole Harbor, Mass.		Naval Target Wreck, Chesapeake Bay, Va.
	Lansford Wreck, Cape Cod, Mass.		San Marcus Wreck (bell), Chesapeake Bay, Va.
	Metropolitan, Boston Harbor, Mass.		Scow Wreck (2), Elizabeth River, Va.
	Mosher Ledge (bell), Buzzards Bay, Mass.		Tangier Sound Entrance, Chesapeake Bay, Va.
	South Channel (7), Boston Harbor, Mass.		29-Foot Lump, 9A (bell), Chesapeake Bay, Va.
	Wreck Shoal, Nantucket Sound, Mass.		30-Foot Spot, 8B, Chesapeake Bay, Va.
3d.....	Almirante Wreck, Seacoast, N. J.		Wolf Trap, 11A (bell), Chesapeake Bay, Va.
	Barge 7, Upper Bay, N. Y.		York River Entrance, Va.
	Beach Channel, Rockaway Inlet, N. Y.		York River (bell), Va.
	Common Fence Point Shoal, Mount Hope Bay, R. I.	6th.....	Jupiter (bell), Seacoast, Fla.
	Cow and Calf, Long Island Sound, N. Y.		Steel Pontoon Wreck, St. Simon Sound, Ga.
	Craven Shoal, Lower Bay, N. Y.		Galveston (2), Tex.
	Dyer Island North Point Shoal, Narragansett Bay, R. I.	8th.....	Southwest Pass (4, including 1 whistling and submarine bell), La.
	Edwin R. Kirk, Upper Bay, N. Y.		Channel Shoal, Buffalo Harbor, N. Y.
	Gedney Channel (2), N. Y.	10th.....	Horseshoe Reef, Buffalo Harbor, N. Y.
	Hallocks Point Shoal, Peconic Bay, N. Y.		Kellys Island South Shoal, Lake Erie, Ohio.
	Hen and Chickens Northeast, Long Island Sound, N. Y.		North Entrance, Lake Erie, Buffalo Harbor, N. Y.
	Hog Neck, Shelter Island Sound, N. Y.		Coyle Point, St. Marys River, Mich.
	Jessup Neck, Shelter Island Sound, N. Y.	11th.....	W. R. Linn Wreck, Lake Huron, South End, Mich.
	Nassau Point, Shelter Island Sound, N. Y.		East Bank, Sturgeon Bay, Wis.
	Northport Bay Entrance, Long Island Sound, N. Y.	12th.....	Gravelly-Island Shoal (bell), Mich.
	Parsonage Point, Long Island Sound, N. Y.		Lee Point (bell), Lake Michigan, Mich.
	Patience Island (bell), Narragansett Bay, R. I.		Northport Point (bell), Mich.
			Oconto Harbor Channel (bell), Wis.
			Racine North Breakwater, Wis.
			Strawberry Channel Southeast, Wis.
		18th.....	San Pablo Dredged Channel (2), Calif.

**FOG SIGNALS ESTABLISHED, IMPROVED, AND DISCONTINUED DURING
THE FISCAL YEAR 1919.**

District.	Location.	Character.	
ESTABLISHED (3).			
8th.....	South Pass Light Vessel, No. 102, Mississippi River, La.	1st-class air siren.	
10th.....	Lorain West Breakwater, Ohio.	Air diaphone.	
17th.....	Line Kiln, Haro Strait, Wash.	3d-class reed horn.	
IMPROVED (8).			
		From—	To—
2d.....	Boston Light Station, Mass..	Steam siren.	Air siren.
5th.....	Thimble Shoal, Chesapeake Bay, Va.	3d-class reed horn.	Air diaphone.
10th.....	Cleveland East Entrance, Ohio.	Electric siren.	Do.
11th.....	Sand Hills, Lake Superior, Mich.	Electric siren.	Do.
12th.....	Frankfort Pierhead, Mich....	Air siren.	Do.
18th.....	Point Arena, Calif.....	Do.	Do.
	Point Montara, Calif.....	Air whistle.	Do.
	Miles Rocks, Calif.....	Steam whistle.	Do.
DISCONTINUED (3).			
5th.....	Bush Bluff Light Vessel, No. 97, Elizabeth River, Va.	Bell operated by clockwork.	
	35-foot Channel Light Vessel, No. 45, Chesapeake Bay, Va.	8-inch chime whistle.	
8th.....	Southwest Pass Light Vessel, No. 102, Mississippi River, La.	1st-class air siren.	

**LIGHT VESSELS ESTABLISHED AND DISCONTINUED DURING THE
FISCAL YEAR 1919.**

District.	Number of vessel.	Name of station.
ESTABLISHED (1).		
8th.....	102	South Pass, Mississippi River, La.
DISCONTINUED (3).		
5th.....	97	Bush Bluff, Elizabeth River, Va.
	45	35-Foot Channel, Chesapeake Bay, Va.
8th.....	102	Southwest Pass, Mississippi River, La.

SUBMARINE SIGNALS DISCONTINUED DURING THE FISCAL YEAR 1919.

District.	Location.
5th.....	Thirty-Five Foot Channel Light Vessel, Chesapeake Bay, Va.
8th.....	Southwest Pass Entrance Gas, Whistling, and Sumarine Bell Buoy, La.

PRIVATE AIDS TO NAVIGATION MAINTAINED ON JUNE 30, 1919.

[Under the act of June 20, 1906.]

District.	Lights.	Buoys.		Other unlighted aids.	Fog signals.	Total.
		Lighted.	Unlighted.			
1st.....			34	2		36
2d.....	39		30	12		81
3d.....	37	1	83	7	2	130
4th.....			4			4
5th.....	16	1	153	52	3	225
6th.....	2	1	7			10
7th.....	6		9	2		17
8th.....	12		20	8		40
9th.....			1			1
10th.....	24	6	4	1	1	36
11th.....	14	1	54	1		70
12th.....	32	2	8		7	49
13th.....		1				1
15th.....	1					1
16th.....	3		1			4
17th.....	2		12		2	16
18th.....	26	2	7	1	11	47
19th.....	18					18
Total.....	232	15	427	86	26	786

BRIDGES OVER NAVIGABLE WATERS LIGHTED ON JUNE 30, 1919.

[Under the act of Aug. 7, 1882, 22 Stat., 309.]

District.	Lighted bridges.	District.	Lighted bridges.	District.	Lighted bridges.
1st.....	22	8th.....	261	15th.....	8
2d.....	63	9th.....	1	17th.....	55
3d.....	214	10th.....	64	18th.....	30
4th.....	17	11th.....	53		
5th.....	157	12th.....	168	Total.....	1,462
6th.....	58	13th.....	80		
7th.....	24	14th.....	187		

AIDS MAINTAINED UNDER CONTRACT DURING FISCAL YEAR 1919.

District.	Name of aids.	Annual cost.
1st.....	Kennebunkport Pier Light, Me.....	\$150.00
7th.....	Caximbas Pass and Big Marco Pass, Fla. (4 buoys).....	72.00
9th.....	Christiansted Harbor, St. Croix, Virgin Islands of U. S. (10 buoys).....	480.00
10th.....	Lake Ontario and the St. Lawrence River, N. Y. (41 buoys).....	3,000.00
	Niagara River and Black Rock Channel, N. Y. (75 buoys).....	230.00
11th.....	Superior Bay, St. Louis Bay and River, Wis. and Minn. (33 lights).....	3,000.00
12th.....	Fox River, Wis. (14 spar buoys); Green Bay, Wis. (17 spar and 2 gas buoys).....	250.00
16th.....	St. Michael Canal and Apoon Pass, Alaska (32 buoys), and Orizaba Reef Bell Buoy.	428.50
	Norton Sound, Alaska (11 lights).....	697.50

LIGHT VESSELS IN COMMISSION DURING THE FISCAL YEAR 1919.

Number.	Station.	District.	Tonnage.		When built.	Material of hull.	Dimensions.				Regular complement.		Fog signal.	Illuminant.	Cost of repairs made during fiscal year.	Cost of maintenance during fiscal year.	Original cost.	On station.	
			Gross.	Net.			Length over all.	Breadth.	Depth.	Indicated horsepower (or self-propelling).	Officers.	Crew.						Months.	Days.
74	Portland, Me.⊙	1	495		1902	Wood	Pl. in. 129 9	Pl. in. 28 6	Pl. in. 13 0	380	4	8	12" steam whistle b...	Acet....	\$4,350	\$16,372	\$88,896	9	23
3	Handverchief, Mass.⊙	2	140		1852	do.	69 4	23 0	10 0	(d)	2	5	Bell.....	do.....	519	8,774	12,000	8	29
4	Relief	2	104		1855	do.	77 0	20 0	10 0	(d)	1	0	Bell or horn.....	Oil.....	21	1,512		8	5
5	Stone Horse Shoal, Mass.⊙	2	104		1864	do.	80 6	21 6	9 0	(d)	2	7	8" air whistle.....	do.....	1,734	10,858		8	25
20	Cross Rip, Mass.	2	165		1867	do.	81 6	21 6	10 0	(d)	2	5	Bell.....	do.....	335	10,520	25,040	12	
9	Hedree Fence, Mass.	2	104		1867	do.	81 2	28 2	9 6	(d)	2	7	8" air whistle b...	Oil.....	1,716	10,348	19,883	11	10
41	Vineyard Sound, Mass.⊙	2	387		1876	do.	120 6	26 9	11 0	(d)	2	7	First-class air siren b...	do.....	5,750	12,973	33,000	8	23
42	Hen and Chickens, Mass.⊙	2	410		1877	do.	121 7	26 6	10 6	(d)	3	7	10" air whistle.....	do.....	7,361	12,529	40,790	8	11
47	Pollock Rip, Mass.⊙	2	476		1891	Comp.	120 10	26 6	11 0	(d)	4	6	12" steam chime wh. b...	do.....	1,764	13,458	60,000	9	16
54	Boston, Mass.⊙	2	310		1892	Steel.	118 10	26 0	11 0	350	4	7	First-class air siren b...	Inc. o. v.	954	15,383	62,000	11	11
66	Great Round Shoal, Mass.⊙	2	4590		1896	Comp.	123 0	28 6	13 0	350	4	8	12" steam chime wh. b...	Acet.....	242	16,240	69,282	12	
73	Pollock Rip Shoal, Mass.⊙	2	4538		1901	Steel.	123 9	28 6	12 9	400	4	8	do.....	Oil.....	3,278	15,083	79,572	10	28
85	Nantucket Shoals, Mass.⊙	2	4683	246	1907	do.	135 5	29 0	13 0	380	5	10	do. b.....	El. inc.	3,574	23,905	99,000	8	9
86	Relief	2	4683	246	1907	do.	135 5	29 0	13 0	380	4	6	do. b.....	Oil.....	1,945	14,262	99,000	7	20
90	Relief	2	4685	225	1908	do.	135 5	29 6	13 0	400	4	6	do. b.....	do.....	1,154	14,737	107,213	7	22
11	Scotland, N. J.⊙	3	320		1853	Wood	104 0	21 8	11 6	(d)	2	5	Bell.....	Oil and oil gas.	3,307	8,646	13,462	11	13
13	Bartlett Reef, Conn.	3	155		1854	do.	79 8	21 8	10 4	(d)	4	5	do.....	Oil.....	24,927	11,924	12,000	2	23
16	Relief	3	250		1854	do.	103 6	22 6	11 0	(d)	1	1	First-class air siren, 6" whistle. b	do.....	6,225	3,217	28,084	10	17
23	Ram Island Reef, Conn.⊙	3	186		1857	do.	91 2	24 0	9 0	(d)	2	5	10" air.....	do.....	3,584	8,476	7,500	10	9
39	Brenton Reef, R. I.⊙	3	387		1875	do.	119 6	26 9	13 0	(d)	4	6	Wh. b.....	do.....	210	12,660	42,200	12	
44	Northeast End, N. J.⊙	3	197		1882	Iron.	115 6	25 0	10 6	(d)	4	8	First-class steam siren b	Acet.....	1,802	13,753	50,000	10	15
48	Cornfield Point, Conn.⊙	3	470		1891	Comp.	120 10	27 8	12 0	(d)	4	6	do.....	Acet. and oil.	1,424	12,721	52,780	9	20
51	Relief	3	283		1892	Iron.	119 10	26 9	11 0	325	2	6	12" steam whistle b...	El. inc.	392	8,944	53,325	3	10
68	Fire Island, N. Y.⊙	3	4590	204	1897	Comp.	122 10	28 6	12 6	350	4	10	12" steam chime wh. b...	do.....	6,383	17,350	74,750	9	27
69	Overfalls, Del.⊙	3	4590	204	1897	do.	122 10	29 6	13 0	350	4	10	do. b.....	do.....	1,089	16,331	79,500	10	1
78	Relief	3	4668	188	1904	Steel.	129 0	28 6	12 6	325	4	6	12" steam whistle b...	Oil or acet.	5,119	11,865	89,030	8	11
79	Five-Fathom Bank, N. J.⊙	3	4608	188	1904	do.	129 0	28 6	12 6	325	4	8	12" steam chime wh. b...	Oil.....	2,463	15,780	89,000	10	9
87	Ambrose Channel, N. Y.⊙	3	4683	246	1907	do.	135 5	29 0	13 0	325	4	10	12" steam whistle b...	E. arc...	398	19,680	99,000	10	30

TENDERS OF LIGHTHOUSE SERVICE IN COMMISSION DURING THE FISCAL YEAR 1919.

Name.	District.	Displacement.		When built.	Description.	Material of hull.	Dimensions.			Mean draft.		Indicated horsepower.	Regular complement.		Miles steamed.	Coal consumed for all purposes.	Cost of repairs.	Cost of maintenance.	Original cost.
		Light.	Tons.				Length over all.	Breadth.	Depth.	Light.	Pl. in.		Officers.	Crew.					
Hibiscus	1	815	1,081	1908	Steamer, twin screw.	Steel	180	30	16	11 0	13 3	1,000	7	26	14,779	2,126	\$12,289	\$57,087	\$184,643
Zizania	1	575	643	1888	do.	Iron	164	27	12	8 9	9 6	650	6	22	9,219	875	752	42,463	18,739
Anemone	2	818	1,073	1908	do.	Steel	190	30	16	11 0	13 0	1,000	7	26	12,544	1,581	7,921	46,370	191,989
Azalea	2	330	516	1891	Steamer, single screw.	do.	154	25	12	9 6	9 0	400	6	22	9,411	800	6,763	40,610	79,792
Mayflower	2	630	668	1897	Steamer, twin screw.	do.	164	30	12	7 9	8 1	650	6	24	10,190	1,363	10,496	49,757	74,872
Daisy	3	64	84	1892	Steamer, single screw.	Wood	80	14	5	4 0	3 9	60	2	5	5,451	127	2,185	9,032	6,500
Gardenia	3	217	245	1879	do.	do.	117	20	9	6 6	6 6	200							
John Rodgers	3	455	571	1883	Steamer, side wheel.	Iron	160	27	9	6 6	7 9	260	4	17	7,294	595	1,077	29,734	59,987
Larkspur	3	758	888	1903	Steamer, twin screw.	Steel	169	30	14	9 1	10 6	750	7	24	13,757	2,277	2,121	53,298	123,259
Mistletoe	3	455	176	1872	Steamer, side wheel.	Wood	160	26	9	6 9	7 0	370	4	16	5,697	570	4,300	27,010	45,833
Fansy	3	431	454	1878	Steamer, twin screw.	Iron	152	25	11	7 7	7 1	250	4	17	6,326	743	2,486	30,209	48,739
Tulip	3	774	1,142	1908	do.	Steel	190	30	16	10 7	13 9	1,000	7	26	18,423	2,032	9,433	54,196	191,658
Myrtle	3	435	542	1872	Steamer, single screw.	Wood	140	25	11	9 6	11 0	225	4	16	16,067	922	3,000	32,651	44,500
Elm	3	259	318	1918	Oil, single screw.	do.	101	30	9	5 6	6 9	150	2	4			854	2,690	93,638
Pine	3	55	56	1918	Gasoline, single screw.	do.	61	15	6	4 3	4 4	50	2	3	951	765	16,903	3,493	16,187
Iris	4	519	600	1897	Steamer, single screw.	Steel	153	30	10	8 7	9 6	800	5	20	9,026	1,082	1,888	29,931	84,407
Woodbine	4	85	107	1913	Gasoline, single screw.	Wood	95	16	7	5 2	5 11	125	2	5	6,408	10	406	14,831	24,728
Columbine	5	429	643	1892	Steamer, single screw.	Steel	155	27	15	9 6	12 3	800	7	23	9,945	1,095	5,627	43,168	58,238
Arbutus	5	398	545	1879	Steamer, twin screw.	Wood	173	25	11	7 1	9 0	360	7	22	8,112	904	20,004	44,233	49,769
Holly	5	431	499	1881	Steamer, side wheel.	Comp.	176	24	10	7 0	8 6	400	5	18	8,997	732	1,281	39,070	41,911
Jessamine	5	369	403	1881	do.	Iron	156	24	10	7 3	7 9	350	4	18	8,094	754	1,537	35,771	41,911
Juniper	5	125	146	1903	Steamer, twin screw.	Steel	95	18	8	4 6	5 0	290	2	9	9,398	628	9,999	19,379	29,425
Laurel	5	218	299	1915	Steamer, single screw.	Wood	105	22	9	6 1	6 10	160	4	12	11,257	450	466	29,120	55,502
Maple	5	567	799	1893	Steamer, twin screw.	Steel	164	30	12	7 3	9 5	650	7	24	7,328	884	810	48,333	93,889
Orchid	5	818	1,081	1908	do.	do.	190	30	16	11 0	13 3	1,000	7	27	16,068	2,196	3,443	61,338	186,151
Cypress	6	760	1,080	1908	do.	do.	190	30	16	10 9	13 3	1,000	7	26	18,419	2,434	\$5,331	\$28,499	191,633
Mangrove	6	606	821	1897	do.	do.	164	30	12	7 6	9 6	550	6	24			\$72,700	\$3,902	74,998

Palmetto.....	6	156	170	1917	Gasoline, twin screw.....do.....	90	22	8	3	8	4	0	150	4	8	6,301	<div><div>11</div><div>{e14,483</div><div>5</div></div>	3,541	21,194	27,687
Water Lily.....	6	29	39	1895	.....do.....	Wood.	64	11	5	2	11	3	8	36	2	3	6,092	371	8,026	9,261
Ivy.....	7	786	916	1904	Steamer, twin screw.....	Steel..	173	30	13	8	5	9	6	700	6	24	11,355	1,890	55,231	123,860	
Snowdrop.....	7	30	41	1896	Gasoline, twin screw.....	Wood.	69	11	5	2	10	3	7	32	2	2	4,907	e4,700	8,305	9,700	
Polnsettia.....	7	27	31	1915	Gasoline, single screw.....	.....do.....	50	16	6	2	5	2	9	50	2	2	104	e180	608	.....
Camellia.....	8	276	377	1911	Steamer, twin screw.....	Steel..	117	24	10	5	10	7	7	280	4	17	6,539	646	31,447	57,412	
Magnolia.....	8	685	877	1904	.....do.....	.....do.....	173	30	13	7	6	9	2	700	6	25	7,497	1,061	*43,739	124,874
Sunflower.....	8	806	1,246	1907	.....do.....	.....do.....	174	31	15	10	5	14	6	900	7	27	10,465	1,433	6,466	124,968
Cosmos.....	8	57	61	1909	Gasoline, twin screw.....	Wood.	75	15	6	3	9	4	0	100	1	4	.....	.....	.....	.....
Lilac.....	9	542	582	1892	Steamer, single screw.....	Steel..	155	27	15	11	0	11	6	800	6	19	5,458	636	4,523	92,125	
Crocus.....	10	681	1,035	1904	Steamer, twin screw.....	.....do.....	165	29	14	9	6	12	3	700	5	23	7,587	1,590	4,096	119,718
Amaranth.....	11	597	975	1892	Steamer, single screw.....	.....do.....	166	28	14	8	6	12	6	672	5	20	11,729	1,250	2,382	74,994
Aspen.....	11	533	745	1906	.....do.....	.....do.....	126	25	12	7	3	8	3	440	4	10	6,324	653	1,491	24,070
Clover.....	11	163	205	1899	.....do.....	Wood.	93	22	7	5	4	6	4	140	4	8	10,362	403	893	17,953
Marigold.....	11	477	696	1890	.....do.....	Iron.....	160	27	12	8	5	11	0	550	5	20	9,745	842	18,934	39,242
Hyacinth.....	12	493	914	1903	.....do.....	Steel.....	165	28	14	7	0	11	6	768	5	20	10,338	1,484	2,061	115,000
Sumac.....	12	600	887	1903	Steamer, twin screw.....	.....do.....	169	30	13	8	10	11	9	700	6	23	11,523	1,543	2,816	114,992
Dandelion.....	13	232	302	1893	Steamer, stern wheel.....	Wood.....	140	31	5	2	6	3	3	500	4	15	5,853	1,126	4,945	26,156	
Goldenrod.....	14	194	283	1888	.....do.....	Steel.....	169	27	4	2	5	3	4	152	.....	.....	.....	.....	.....	33,221
Oleander.....	15	463	548	1903	.....do.....	.....do.....	189	34	7	3	10	4	6	600	4	17	11,156	1,787	3,366	60,000
Fern.....	16	245	317	1915	Steamer, single screw.....	Wood.....	112	22	10	1	8	6	6	300	5	11	10,910	1,992	4,949	30,176	
Cedar.....	16	1,245	1,970	1917	.....do.....	Steel.....	201	36	18	9	6	14	0	1,150	8	25	14,839	11,730	7,098	93,642
Heather.....	17	631	831	1903	.....do.....	.....do.....	179	28	15	9	6	11	6	685	7	20	9,209	1,836	661	47,512
Manzanita.....	17	774	1,000	1908	Steamer, twin screw.....	.....do.....	190	30	16	10	7	12	7	1,000	7	23	8,816	2,012	3,380	54,861
Rose.....	17	395	567	1916	.....do.....	.....do.....	127	24	11	7	0	9	4	330	5	16	8,426	e16,345	1,264	*3,433
Madrona.....	18	654	806	1885	Steamer, single screw.....	Iron.....	180	27	15	9	9	11	6	750	7	20	9,399	1,175	*16,885	*21,612	
Sequoia.....	18	809	1,100	1908	Steamer, twin screw.....	Steel.....	190	30	16	10	11	13	5	1,000	7	23	10,994	1,475	*1,270	*20,698	
Kukul.....	19	838	935	1908	.....do.....	.....do.....	190	30	16	11	2	12	0	1,000	7	23	10,653	1,543	2,396	64,613
																				213,880	

^a Light=without cargo and deck loads, and a minimum supply of stores, provisions, water, and coal or oil.

^b Loaded=bunkers or fuel-oil tanks full of coal or oil, all tanks, including trimming tanks, full of water; full stores and provisions, and an average maximum cargo and deck load.

^c Condemned.

^d Length between perpendiculars.

^e Gallons gasoline.

^f Equipped with radio.

^g Displacement (fresh water).

^h Barrels of fuel oil. 1 barrel=42 gallons.

* Amounts for maintenance and repairs paid direct by Navy Department not included in figures shown.

CONSTRUCTION OF TENDERS AND LIGHT VESSELS.

Tender "Aster" and barge.—The act of July 1, 1916, appropriated \$20,000 for constructing or purchasing and equipping a small tender and barge for the eighth district, Texas and Louisiana. It was proposed to purchase a suitable vessel for a tender and construct the barge from plans and specifications now in preparation. Bids were twice invited for the purchase of a suitable tender without satisfactory results owing to the scarcity of vessels caused by war conditions. Design for a suitable type of vessel has been secured from which plans and specifications for a tender are now being prepared. Amount expended to June 30, 1919, \$13.14.

Tender "Elm."—The act of July 1, 1916, appropriated \$100,000 for aids to navigation, Hudson River, N. Y. It was found that in the construction of these aids a light-draft power barge, with derrick, was required. A suitable barge available for purchase could not be found, and accordingly plans and specifications were prepared for a wooden, power, derrick barge, and on January 13, 1917, a contract was awarded to Rice Bros., East Boothbay, Me., for the construction of the hull, in the sum of \$29,400. The keel, stem, sternpost, and frames were partly completed when, on July 10, 1917, a disastrous fire occurred at the plant of the above concern, destroying all but four frames; the keel, stem, and sternpost were uninjured.

New material was immediately procured and reconstruction commenced. The vessel was launched on June 5, 1918, and completed and delivered on July 23, 1918, ready for the installation of the propelling machinery and auxiliaries by the Government; which latter work was completed and the vessel placed in commission July 18, 1919.

Tender "Pine."—Due to the increase in traffic and the additional aids established along the inlets of the New Jersey coast, the need of a small, light-draft tender became apparent, and it was proposed to purchase a suitable vessel, but none was found that could be adapted to the work. Plans and specifications were accordingly prepared and bids invited for a light-draft power boat, and on June 27, 1918, a contract was awarded to the Nyack Shipbuilding Co., Nyack, N. Y., for the construction of a power boat in the sum of \$9,500, payable from general expenses Lighthouse Service, 1918. The boat was completed, delivered, and placed in commission on December 9, 1918. Later a new type derrick and boom operated by a gasoline hoisting engine were installed.

Tender "Oak."—The act of June 12, 1917, appropriated \$150,000 for a lighthouse tender for the third district to replace the tender *Gardenia* or for general service.

Specifications were prepared and bids invited for the construction of the vessel. The lowest bid received being greatly in excess of the appropriations, all were rejected. Bids were again invited on August 1, 1919, after extensive advertisement. The lowest bid received was again greatly in excess of the appropriation, and all bids are held in abeyance pending further appropriation of funds. Amount expended to June 30, 1919, \$9,077.77.

Light vessel "No. 99."—The act of August 24, 1912, appropriated \$130,000 for a light vessel for general service. Plans and specifications were prepared for a light vessel for the Great Lakes. Bids were received on May 25, 1916, and, on June 29, 1916, a contract was awarded to Rice Bros., East Boothbay, Me., in the sum of \$61,000. The construction of the vessel had reached a degree of completion of approximately 54 per cent, when, on July 10, 1917, a disastrous fire occurred at the builders' plant in which the vessel and the greater part of its fittings were rendered a total loss.

The contractors took prompt steps to procure new material, and the construction of a new vessel, a duplicate of the one destroyed, was commenced. On June 30, 1919, the work had reached a degree of completion of approximately 68 per cent. Amount expended to June 30, 1919, \$68,972.73.

Light vessel "No. 100."—Plans and specifications are in preparation for a large light vessel for station at Nantucket Shoals, Mass. There is a balance of approximately \$51,600 remaining under the appropriation of August 26, 1912, for light vessels, but the construction of this vessel from the available balance will not be possible until additional funds are available to meet the higher costs of production caused by the present abnormal conditions. Estimates have been prepared and submitted, and it is now proposed to construct this vessel from the plans and specifications prepared for light vessel No. 105.

Light vessels "No. 103" and "No. 104."—The act of June 12, 1917, appropriated \$150,000 for light vessels for general lake service. Plans and specifications for two vessels similar in construction to light vessel No. 99 have been completed. Bids were received for the construction of one or both vessels, on January 15, 1918, and on June 5, 1918, a contract was awarded to the Gas Engine & Power Co. and the Charles L. Seabury Co., Morris Heights, N. Y., in the sum of \$147,428 for the construction of one

vessel, No. 103. It is proposed to invite new bids for light vessel No. 104 when funds are available, estimates for which have been prepared and submitted. The construction of light vessel No. 103 had reached a degree of completion of approximately 30 per cent on June 30, 1919. Amount expended up to June 30, 1919, \$112.22.

Light vessel "No. 105" (Cape Charles).—The act of June 12, 1917, appropriated \$130,000 for a light vessel for Cape Charles, Va., or for general service. Plans and specifications were prepared and bids invited for the construction of the vessel. The lowest bid received was greatly in excess of the appropriation and all bids are held in abeyance pending further appropriations, estimates for which have been submitted. No expenditures were made to June 30, 1919.

Radio equipment for lighthouse vessels.—The act of June 12, 1917, appropriated \$60,000 for installing radio equipment on lighthouse tenders, seven tenders having been previously so equipped. This amount has not been expended, the Navy Department having used naval appropriations for the equipment of 16 tenders with radio during the war, 12 of these having been equipped during the fiscal year 1919. In all, 23 tenders were equipped with radio at the end of the fiscal year 1919. The appropriation of June 12, 1917, will be used to equip other tenders with radio apparatus as soon as practicable.

At the end of the fiscal year 41 light vessels had been equipped with radio apparatus, 32 light vessels having been so equipped during the war and 28 of these during the past fiscal year. Nine light vessels had been previously equipped with radio. The installation of radio on other light vessels is in progress. This work has been done by the Navy Department in cooperation with the Lighthouse Service and was paid for with funds from naval appropriations.

SPECIAL WORKS OF CONSTRUCTION COMPLETED (OMITTING VESSELS).

FIRST DISTRICT.

Dog Island, Eastport, Me.—The act of July 1, 1916, appropriated \$3,500 for establishing an unattended light on Dog Island, Eastport, Me. Considerable delay in establishing this light was caused by having to obtain title to the site by condemnation proceedings. The tower was erected during October and November, 1918, and the light shown for the first time on January 23, 1919. The tower is a steel, skeleton structure having a concrete foundation and steel tank house. Amount expended to June 30, 1919, \$3,130.35.

EIGHTH DISTRICT.

Aids to navigation, Caribbean Sea.—An allotment of \$100,000 was made by the President from the appropriation for national security and defense for the purpose of establishing lighted aids in the western part of the Caribbean Sea to mark the traffic lane between the western end of Cuba and the Panama Canal through the Yucatan Passage. A working party of Lighthouse Service employees was assembled, together with materials, in the eighth district. On June 3, 1919, the party sailed from New Orleans, La., on the U. S. S. *Wheeling* for the Caribbean Sea, and the work was done under the direction of the superintendent on general duty. Flashing white lights were established on three 40-foot skeleton steel towers which were erected upon concrete blocks in the following locations: Quita Sueno Bank, Roncador Cay, and Serrana Bank. The expenditures and obligations to June 30, 1919, were \$26,163.87.

TENTH DISTRICT.

Lorain Harbor, Ohio.—The act of October 22, 1913, appropriated \$35,000 for a light and fog-signal station and improvement to aids to navigation at Lorain Harbor, Ohio. A reinforced-concrete structure for the light and fog signal has been completed. The permanent light was placed in commission April 7, 1919, and the fog signal May 13, 1919. Amount expended to June 30, 1919, \$34,974.54.

ELEVENTH DISTRICT.

Sand Hills Light Station, Mich.—The act of June 12, 1917, appropriated \$70,000 for the construction of a light and fog-signal station at Sand Hills, Mich. A site was purchased about 3½ miles west of Eagle River, Mich., on what is known as Five Mile Point and construction work actively commenced in the late fall of 1917. The fog signal was placed in commission on May 15 and the light on June 18, 1919. The tower is of brick and structural steel, forming the central feature of the main structure, which forms the quarters for the three keepers. Amount expended to June 30, 1919, \$68,714.69.

SEVENTEENTH DISTRICT.

Lime Kiln Light Station, Wash.—The act of July 6, 1916 (Kellett Bluff Light Station, Wash.), appropriated \$40,000 for the construction of a light and fog-signal station at or near Kellett Bluff, Henry Island, Wash. A site known as Lime Kiln, on the west coast of San Juan Island, was selected and construction begun in August, 1918. The station was placed in commission June 30, 1919. It consists of a combined light and fog-signal building, with light tower 30 feet high and two keepers' dwellings, all of reinforced concrete. Amount expended to June 30, 1919, \$38,333.80.

Aids to navigation, Puget Sound, Wash.—The act of October 22, 1913, appropriated \$30,000 for aids to navigation and improvements to existing aids in Puget Sound, Wash., and adjacent waters. From this appropriation a new light and fog-signal building has been constructed at Marrowstone Point, Wash., the light changed from acetylene to electricity, and the fog signal from an acetylene gun to an air-operated reed horn. A flashing acetylene light has also been established at Apple Cove Point, Wash. The balance of the appropriation has been expended for a structure for Shilshole Bay Outer Light. Amount expended to June 30, 1919, \$30,000.

SPECIAL WORKS OF CONSTRUCTION UNCOMPLETED (OMITTING VESSELS).

SECOND DISTRICT.

Nantucket Harbor Fog Signal, Mass.—By act of July 1, 1918, the appropriation of \$15,000 contained in act of March 28, 1918, for a fog-signal whistle was made available for establishing an electrically operated fog bell on the east breakwater at Nantucket Harbor, Mass. The fog-bell tower has been completed and the bell and striker installed. The submarine cable has been purchased and laid and the generating apparatus in duplicate has been purchased and installed in the old tower at Brant Point. Amount expended to June 30, 1919, \$6,582.53.

Woods Hole (Mass.) Lighthouse Depot.—The act of July 1, 1916, appropriated \$50,000 for improvements at Woods Hole Depot, Mass. About 32,000 feet of channel, 150 feet wide, was dredged to a depth of 17 feet, and a basin in front of depot 400 by 550 feet was dredged to 17 feet at a cost of \$30,162.97. A two-story storehouse, 35 by 80 feet, of brick, with steel frame and reinforced-concrete floors and roof, was finished by contract August 18, 1917. The electric lighting has been installed and an electric welding outfit purchased and installed. Amount expended to June 30, 1919, \$49,028.72.

Depot for second lighthouse district.—The act of July 1, 1918, appropriated \$85,000 for building a depot at Chelsea, Mass. Proposals for dredging and building two slips and for rebuilding the wharf were invited and opened on April 30, 1919, but were rejected owing to excessive prices. New proposals for dredging in front of wharf and east slip and for rebuilding wharf and retaining walls have been issued to be opened August 1, 1919. No expenditures were made to June 30, 1919.

Repairing and rebuilding aids to navigation, Atlantic coast.—From the appropriation by the deficiency act approved November 4, 1918, \$11,000 was allotted for repairing damage done by ice during the winter 1917-1918 at Duxbury Pier Light Station and Scituate Breakwater Light. Six hundred tons of riprap, ranging in size from 1 to 5 ton stones, were deposited at Duxbury Pier Light Station in a mound on the north-westerly side of the tower and about 25 feet from it to protect the tower from heavy field ice and to give a more sheltered landing for the keepers. As soon as the riprap has thoroughly settled it will be securely fastened together with 1½-inch iron dogs. Five hundred tons of granite riprap were deposited at Scituate Breakwater Light around the spindle to make a secure mound for supporting an acetylene tank house. These stones will be securely dogged during the present season, and the acetylene apparatus purchased for the site will be properly installed. Amount expended to June 30, 1919, \$11,000.

THIRD DISTRICT.

Aids to navigation, Hudson River, N. Y.—The act of July 1, 1916, appropriated \$100,000 for improving aids to navigation and the establishment of new aids on the Hudson River, N. Y. The work of improving, rebuilding, and establishment of the aids will affect 21 different points. The work in progress consists of building and equipping a barge for the purpose, taking necessary steps toward the acquisition of required sites and the purchase of the illuminating apparatus. Work on the barge was delayed on account of destruction by fire of the contractors' shipyard. The barge was finally completed in 1918. The work accomplished up to the present consists of obtaining sites, purchasing lighting equipment, building towers, and completing

the barge. Work of installing the towers and foundations will be started at once. The project was started in December, 1916, and it is expected will be completed about November 1, 1919. The amount expended to June 30, 1919, was \$81,665.18.

Hunts Point, N. Y.—The act of March 4, 1911, appropriated \$5,000 for the establishment of a light and fog signal to mark Hunts Point, between Hell Gate and White-stone Point, East River, N. Y. The work of erecting a structure for the light and fog signal was started in November, 1916, and the light went into commission on January 4, 1917. The structure consists of a steel tower built on a stone-and-concrete foundation, with the necessary provision made for the establishment of a fog signal later, when it is practicable to procure electric current for its operation. The date of the completion of this project is indefinite, but it is expected that it will be possible to get current and have the fog signal in operation by June 1, 1920. Amount expended to June 30, 1919, \$3,520.21.

Staten Island Lighthouse Depot, N. Y.—The act of June 12, 1917, appropriated \$21,000 for improving the office and laboratory at the general lighthouse depot. The work was started in November, 1918, and has all been completed with the exception of certain minor details and the work of installing a heating system and wash rooms. It is expected the entire building will be completed by November 15, 1919. Amount expended to June 30, 1919, \$7,857.16.

Aids to navigation, East River, N. Y.—The act of June 12, 1917, appropriated \$16,000 for improving the aids to navigation in the East River, N. Y. The work to be done consists of improvements and changes in the present system of lights and the establishment of an additional light. The lighting apparatus has been purchased. The necessary grants for the parcels of land under water have been obtained, and bids for riprap foundations will be invited in the near future. The work was started in September, 1917, and it is expected will be completed about May 1, 1920. Amount expended to June 30, 1919, \$7,947.97.

Great Salt Pond Light Station, R. I.—The act of June 12, 1917, appropriated \$20,000 for building a new dwelling and moving the fog signal from the inner to the outer end of the breakwater. Plans for dwelling are completed. Cession of land and jurisdiction over same has been received from the State of Rhode Island. Contract has been entered into for furnishing and placing the necessary riprap for the foundation of the light, and about one-fourth of the quantity of stone contracted for has been delivered and placed on the site. Owing to increase in the cost of labor and material and to change in location of light to the extreme end of the breakwater to make the harbor convenient as a base for naval vessels, an additional appropriation is required to complete this work. The estimated additional amount required is \$53,000. Work was started in May, 1919, and it is expected it will be completed about June 1, 1920, if funds are available. Amount expended to June 30, 1919, \$16.62.

Staten Island Lighthouse Depot, N. Y.—The act of March 28, 1918, appropriated \$60,000 for repairing the wharves at the general lighthouse depot, Tompkinsville, N. Y. It is proposed to remove the old wooden decks, furnish and install additional steel work, cast-iron pile columns, manhole frames, covers, and pipe hangers, and place new concrete decks on the wharves. A contract was entered into for the work to be done to the south wharf. The work was started in September, 1918, and completed in February, 1919. On account of incessant use of wharves it will be necessary to do this work in three sections, one at a time. Contract has been entered into for the second section, and it is expected the work will start in July, 1919, and be completed in September, 1919. Amount expended to June 30, 1919, \$33,789.82.

Ambrose Channel Lighted Buoys, N. Y.—The act of July 1, 1918, appropriated \$26,000 for improving the system of lighted buoys in Ambrose Channel, N. Y. The plan of general change has been approved and buoys for making the change were ordered June 17, 1919, and it is expected to have the work completed about March 1, 1920. No expenditures have yet been made from this appropriation.

Plate shop, coal shed, etc., General Lighthouse Depot, N. Y.—In August, 1918, an allotment of \$175,000 was made from funds for national security and defense to carry out certain necessary alterations and provide certain necessary equipment at the general lighthouse depot, Tompkinsville, N. Y. These consisted of the removal of the old coal shed, the erection of a new coal shed, and the erection of two temporary coal bins for use while the new coal shed was being built, and to erect on the site of the old coal shed an extension to the present blacksmith's shop to be used as a boiler and plate shop. Temporary coal bins were erected, the old coal shed was torn down, and a new iron rack built to replace one removed to make room for plate shop. Contract has been entered into for the erection of the new coal pocket and for furnishing new plate-working machinery. It is expected the work on new coal pocket will be started about July 3, 1919, and will be finished about December 30, 1919. It is expected the entire project will be completed about February 1, 1920. Amount expended to June 30, 1919, \$16,635.85.

FOURTH DISTRICT.

Joe Flogger Shoal, Del.—The act approved July 1, 1918, provided that the unexpended balance of the appropriation of \$40,000 "toward a light and fog-signal station of the Joe Flogger Shoal, Delaware River," contained in the act approved June 13, 1906, be made available for establishing gas buoys and improving aids to navigation in the vicinity of Joe Flogger Shoal, Del. Under this appropriation five modern gas buoys are now being manufactured, and orders for additional buoys, etc., will be placed in the near future. It is expected that all work under this appropriation can be completed during 1920. Amount expended to June 30, 1919, \$609.25.

Delaware River, Pa. and Del., aids to navigation.—The act of March 3, 1915, authorized this work. The act of July 1, 1916, appropriated \$80,000 for the purpose. Under the appropriation the following work was performed or was underway at the close of the fiscal year:

Chester Range Front: This station was completed. It consists of a foundation crib in 13 feet at mean low water supporting a 50-foot structural-steel tower, from which is shown a flashing automatic acetylene light. Station is protected by riprap.

Chester Range Rear: This station was completed. It consists of a 100-foot structural-steel tower on concrete piers supported by timber grillage. The light is fixed-white, automatic, acetylene.

Marcus Hook Range Front: This station was completed. It consists of a concrete block on a pile foundation at low-water mark, supporting a 72-foot structural-steel tower, from which is shown a flashing, automatic, acetylene light.

Marcus Hook Range Rear: This station when completed will consist of a 100-foot detached, concrete tower and a brick dwelling. The light will be incandescent oil vapor and be shown from a range lens. It is 95 per cent completed. A temporary acetylene light is shown from the balcony of the new tower. Approximate date of completion is October 1, 1919. Under the appropriation the bell at Fort Mifflin fog signal was replaced by an electric siren. All work under this appropriation should be completed during 1920. Amount expended to June 30, 1919, \$57,429.48.

FIFTH DISTRICT.

Aids to navigation, Cape Charles City, Va.—The act of June 12, 1917, appropriated \$12,800 for improving lights and fog signals leading to Cape Charles City, Va. Plans and specifications have been prepared for the ironwork and the erection of Cherry-stone Bar Light to cover a small, caisson-type structure which will show an unwatched acetylene light and support an automatic fog bell actuated by carbon-dioxide gas. The ironwork is on hand, and the contract has been let for the erection of the structure. Amount expended to June 30, 1919, \$3,524.

Aids to navigation, Chesapeake Bay, Md. and Va.—The act of June 12, 1917, appropriated \$29,000 for aids to navigation of the Eastern Shore of the Chesapeake Bay and tributaries. Requisition has been made for four type S buoys for the Susquehanna River and the Eastern Shore, Md., of which one has been delivered. Amount expended to June 30, 1919, \$5,865.47.

Repairing and rebuilding aids to navigation, Atlantic Coast.—The act of March 28, 1918, appropriated \$150,000 for rebuilding, repairing, and reestablishing aids damaged by storm and ice, from which \$100,000 was allotted to the fifth district. The act of November 16, 1918, appropriated \$284,000 additional for the fifth district for the same purpose. Riprap has been placed at the following light stations to protect them from further damage: Cedar Point, Point Lookout, Ragged Point, Blakistone Island, and Mathias Point Shoal, all in Maryland. Ironwork has been repaired at Love Point Shoal Light Station, Md., and Killick Shoal Light Station, Va. Contract has been let for repairs to ironwork at Thomas Point Shoal Light Station, Md. Contract has been let for concrete foundation, and work is in progress at Tangier Sound Light Station, Va. Bids were rejected as excessive for new foundation for Brant Island Shoal and Wade Point Light Station, N. C. New plans for the work are in preparation. Contract has been awarded for protecting with riprap stone the following light stations: Thomas Point Shoal, Cedar Point, Point Lookout, Cobb Point Bar, and Maryland Point, all in Maryland; and Windmill Point, Va. Plans and specifications have been prepared for a steel sheet piling and concrete foundation for Old Plantation Flats Light Station, Va. One hundred and eighty minor lights and daymarks, which were damaged or carried away by ice, have been repaired, rebuilt, or reestablished. Amount expended to June 30, 1919, \$102,944.95.

Additional gas buoys.—Appropriations amounting to \$125,000 were made by acts of Congress approved July 1, 1918, and November 4, 1918, for additional gas buoys for the improvement of aids to navigation in the fifth district. Requisition has been made on the general depot for the following: Five gas and whistling buoys, 8 gas and bell buoys, 13 gas buoys, 19 buoy lanterns, and other material.

In addition, one gas and whistling buoy has been purchased for Cape Lookout Harbor of Refuge. The amount expended to June 30, 1919, was \$120,209.21.

SIXTH DISTRICT.

St. Johns River, Fla.—The act of July 1, 1916, appropriated \$66,000 for improving aids to navigation and establishing new aids on the St. Johns River, Fla.

From this appropriation the following works have been accomplished: Six lights, 3 unlighted beacons, and 2 gas buoys have been established; 14 light structures have been rebuilt; buoyage improved and repairs effected at various stations; and illuminating apparatus purchased for converting 3 range lights from oil to acetylene. The amount expended to June 30, 1919, was \$35,098.03.

SEVENTH DISTRICT.

Florida Reefs, Fla.—The act of July 1, 1916, appropriated \$75,000 for establishing additional aids and repairing and improving existing aids. Under this appropriation part of the illuminating apparatus has been purchased. Three attempts have been made to obtain proposals for metal work and glass without success; advertisement for proposals for these materials have again been issued, to be opened on August 30, 1919. The date of completion is indefinite. Amount expended to June 30, 1919, \$3,427.56.

EIGHTH DISTRICT.

Aids to navigation, Atchafalaya Entrance Channel, La.—The act of October 22, 1913, appropriated \$50,000 for establishing aids to navigation in Atchafalaya Entrance Channel, La. During the fiscal year ended June 30, 1916, Point Au Fer Reef Lighthouse and Atchafalaya Entrance Channel Lights Nos. 1, 3, 5, 7, 9, and 2 were completed. A 42-foot motor launch was completed by the United States Naval Station, New Orleans, La., during the fiscal year 1918 at a cost of \$6,951.71. Amount expended to June 30, 1919, \$40,995.06.

Aids to navigation, Mississippi River, La.—The act of July 1, 1916, appropriated \$50,000 for the improvement of aids to navigation of the Mississippi River below New Orleans. Contract was entered into June 22, 1917, for furnishing 25 structural-steel towers. The towers were delivered to the Mobile depot during the year. Amount expended to June 30, 1919, \$18,658.07.

Aransas Pass Light Station, Tex.—The act of October 6, 1917, appropriated \$20,000 for repairing and rebuilding dwellings, outbuildings, and appurtenant structures damaged or destroyed in the hurricane of August 18, 1916. During the fiscal year 1918 the contract was awarded for building a dwelling, oil house, T wharf, walks, etc. The contractor commenced work at the station during May, 1918, and at the end of the fiscal year 1919 had completed the outhouses, oil house, walks, and wharf, and had progressed to the plastering of the dwelling and was engaged in work on the roof, pavement under dwelling, painting, etc. Amount expended to June 30, 1919, \$10,450.95.

Galveston Jetty Light Station, Tex.—The act of June 11, 1896, appropriated \$35,000, and the act of May 27, 1908, \$10,000 for establishing a light and fog-signal station at or near the outer end of one of the jetties at Galveston Harbor, Tex. Great damage was done the uncompleted structure by the hurricane of August 16-17, 1915, which destroyed the construction wharf, bent the framework of the structure, and washed away much material. Subsequently materials were again assembled, another wharf erected, and the framework straightened. The construction work was again washed away in the hurricane of August 18, 1916, and some of the lower struts of the substructure were again bent. A portion of the lens for this station was lost in the hurricane of July 5-6, 1916, one box containing parts of same having been washed away from the Mobile Lighthouse Depot. It was replaced from the third district. In March, 1917, the installation of intermediate beams to reinforce struts was completed. A concrete block 40 feet square around foundation piles, and in places 10 to 15 feet in depth, on northerly and southerly edges, was completed during the fiscal year

1918, and the illuminating apparatus was installed. A fog bell struck by machinery will be installed during the next fiscal year. The light was exhibited November 12, 1918. Amount expended to June 30, 1919, \$44,901.13.

Repairing and rebuilding aids to Navigation, Gulf of Mexico.—The act of February 28, 1916, appropriated \$200,000 for repairing and rebuilding aids to navigation damaged or destroyed by hurricane on the Gulf of Mexico. In addition to the work which had been completed, as stated in the annual reports for the fiscal years ended June 30, 1917, and June 30, 1918, there is given below a list of the work that has been completed during present fiscal year and that in progress. During the fiscal year the following portions of the work have been completed:

Bayou St. John Light Station, La.: Wharf, fence, roof, and gutters repaired.

Cape San Blas Light Station, Fla.: Tower moved to new location.

Cat Island Light Station, Miss.: New wharf on creosoted piles, with creosoted stringers, headers, and braces; new boathouse on square, sawn, creosoted piles, with cast-iron pipe sleeves; new platform under station, etc.

Chandeleur Light Station, La.: Rebuilt wharf and walk, and platform under house, and minor repairs made.

Pass Manchac Light Station, La.: Rebuilt 130 feet cypress sheet-pile break-water; storehouse and boathouse on creosoted piles; also rebuilt fence, etc.

Sabine Bank Light Station, Tex.: Iron shell plates, davits, footplates, railing, etc., were installed, closing in the veranda.

St. Andrews Bay Range Front Light, Fla.: Temporary, single, iron-cased pile structure rebuilt, showing a post-lantern light.

The following work is in progress at the end of the fiscal year:

Calcasieu Range Rear Light Station, La.: Rebuilding walk, boathouse, and repairing station.

Galveston Depot, Tex.: Creosoted piles and untreated lumber, etc., purchased.

Amount expended to June 30, 1919, \$179,784.74.

The act of September 8, 1916, appropriated \$125,000 for repairing and rebuilding aids to navigation damaged or destroyed by hurricane on the Gulf of Mexico, of which \$122,200 was allotted for this district. In addition to the work which had been completed, as stated in the annual reports for the fiscal years ended June 30, 1917, and June 30, 1918, there is given below a list of the work that has been completed during present fiscal year and that in progress. During the fiscal year the following portions of the work have been completed:

Cape San Blas Light Station, Fla.: Tower moved to new location.

Chandeleur Light Station, La.: Wharf, walk, platform, and stairways rebuilt.

Pascagoula River Entrance Light Station, Miss.: Rebuilt 180 feet of walk, fence, and repaired water-closet, gallery, steps, etc.

Ship Island Light Station, Miss.: Wharf, walk, and bulkhead rebuilt.

Amount expended to June 30, 1919, \$109,712.01.

The act of March 28, 1918, appropriated \$100,000 for rebuilding, repairing, and re-establishing aids to navigation and structures connected therewith on the coast of the Gulf of Mexico damaged or destroyed by hurricane. There is given below a list of work which has been completed during the present fiscal year and of that in progress. During the fiscal year the following portions of the work have been completed:

Bayou Chamier Range Rear Light, Miss.: Rebuilt single iron-cased pile structure showing a post-lantern light.

Blackwater Bay Channel Range Lights, Fla.: Both structures repaired.

Cape San Blas Light Station, Fla.: Rebuilt brick oil house in new location.

Deer Point Light, Fla.: Four iron-cased pile structures rebuilt, showing a lens-lantern light.

East Bay Channel Range Lights, Fla.: Both structures repaired.

Fair Point Light, Fla.: Four iron-cased pile structures rebuilt, showing a lens-lantern light.

Middle Beacon, Fla.: Rebuilt as a single iron-cased pile structure with topmast and day mark.

White Point Light, Fla.: Four iron-cased pile structures rebuilt, showing a lens-lantern light.

The following work is in progress at the end of the fiscal year:

Circle Crossing Range Lights, Fla.: Rebuilding one single iron-cased pile structure and repairing the other.

Hurricane Crossing Range Rear Light, Fla.: Rebuilding single-pile structure.

Santa Rosa Sound Range Lights, Fla.: Rebuilding both structures on four iron-cased piles, showing lens-lantern lights.

Amount expended to June 30, 1919, \$44,595.60.

Sabine Pass Jetty Light, La.—The act of May 27, 1908, appropriated \$40,000 for a light and fog signal at or near the end of Sabine Pass Jetty. . Nothing has been done on the work in view of the proposed project of the War Department to extend the jetties to the 25-foot contour, a distance of possibly 2 miles. At the close of the fiscal year 1919 no money had been expended or obligated.

Sand Island Light Station, Ala.—The act of July 1, 1919, appropriated \$37,000, for improvements. At the close of the fiscal year, no money had been expended or obligated.

NINTH DISTRICT.

Point Borinquen Light Station, P. R.—The act of June 12, 1917, appropriated \$85,000 for constructing Point Borinquen Light Station. The third-order lantern and metal work for the station are being made by contract, and the work is nearing completion. Plans and specifications for construction of tower and dwelling are prepared, and bids will be invited by the Bureau as soon as the metal work is completed. Work on illuminating apparatus is in progress at the general depot. Amount expended to June 30, 1919, \$11,394.13.

Aids to navigation, Guantanamo Bay, Cuba.—The act of July 1, 1918, appropriated \$14,000 for dwellings for keepers of lights in Guantanamo Bay, Cuba, and improving the lighting. Contracts have been let for furnishing materials for dwelling, which will be built by hired labor. Skeleton steel towers for Hicacal Beach and Fishermans Point Ranges, and submarine-cable electric equipment for these lights have been ordered. Amount expended to June 30, 1919, \$3,680.

Dwelling, Port San Juan Light Station.—The act of July 19, 1919, appropriated \$50,000 for light keepers' dwellings. The Bureau has requested preliminary plans and report for a double dwelling for Port San Juan Light Station.

TENTH DISTRICT.

Conneaut Harbor, Ohio.—The act of July 1, 1916, appropriated \$63,500 for a light and fog-signal station and improving aids to navigation at Conneaut Harbor, Ohio. Concrete foundation completed. Metal work, brick, stone, and other materials for superstructure delivered at site. Contract awarded for lantern. Work at site on superstructure resumed in June, 1919. Additional appropriation of \$19,600 required to complete project. Probable date of completion August 1, 1920. Amount expended to June 30, 1919, \$42,478.22.

Huron Harbor, Ohio.—The act of June 12, 1917, appropriated \$4,500 for establishing aids to navigation at Huron Harbor, Ohio. Steel tower erected on concrete foundation ready for installation of electric light. Work in progress. Light will probably go in commission about July 15, 1919. Amount expended to June 30, 1919, \$3,450.34.

Fairport Harbor, Ohio.—The act of June 12, 1917, appropriated \$42,000 for improving aids to navigation at Fairport Harbor, Ohio. Plans for this project are being prepared. Owing to war conditions and increased prices, the amount appropriated is insufficient, and an additional appropriation of \$35,500 has been recommended. Amount expended to June 30, 1919, \$1,395.

ELEVENTH DISTRICT.

Detroit River, Mich.—The act of March 4, 1911, appropriated \$210,000 for establishing aids to navigation along the Livingstone Channel, Detroit River, Mich. Twelve concrete piers have been constructed, nine of which have been provided with lights, the lighting of the other three having been deferred pending contemplated changes in the channel by the United States engineers. Two more lighted piers will be established when these changes have been completed. A semaphore system has also been installed for controlling the movements of vessels through the channel. In addition to these fixed aids, 13 gas buoys and 21 spar buoys are in commission. Plans have also been prepared for a light and fog signal at the southern end of the channel, but, as the site is in Canadian waters, no further steps have been taken toward the construction of this station by the United States. Negotiations are, however, under way with the Canadian Government for the establishment by them of a suitable aid at this place. Amount expended to June 30, 1919, \$150,991.19.

Aids to navigation, Fighting Island Channel, Detroit River, Mich.—The act of July 1, 1916, appropriated \$25,000 for aids to navigation, Fighting Island Channel, Detroit River, Mich. Two nonattended acetylene lights and four acetylene gas buoys have been established, and single lights maintained in place of four ranges which are no

longer required owing to straightening of channel. Lighting equipment has been purchased for converting three of these single lights to nonattended acetylene. Amount expended to June 30, 1919, \$18,005.32.

Aids to navigation, Keweenaw Waterway, Mich.—The act of June 12, 1917, appropriated \$100,000 for aids to navigation, Keweenaw Waterway, Mich. The features included in this project are as follows: New dwelling for keeper and enlarging present single dwelling to a double dwelling, power house, boathouse, oil house, light and fog-signal station and establishment of 20 minor lights with electric illuminant along the Portage River. Practically all material has been delivered, and the work of construction is well advanced. It is expected that the principal structures will be completed this season, and the entire project, with the exception of a few minor lights, finished during the present fiscal year. Amount expended to June 30, 1919, \$72,909.

Aids to navigation, St. Marys River, Mich.—The act of November 7, 1918, appropriated \$80,000 for improving aids to navigation in St. Marys River, Mich. The work contemplated includes the establishment of two acetylene lights, repairs and improvements to existing aids, quarters for one keeper, and electric generating station and wiring equipment for lights in Middle Neebish Channel. Acetylene equipment and steel towers have been delivered and work actively begun. Amount expended to June 30, 1919, \$1,391.39.

Spectacle Reef Light Station, Mich.—The act of July 1, 1918, appropriated \$28,000 for repairing the substructure of this station, which is being seriously undermined. Preliminary examinations have been made and will be extended during the current season and arrangements completed for carrying out the work next year. No expenditures have been made from this appropriation.

Detroit Lighthouse Depot, Mich.—The act of July 1, 1918, appropriated \$53,000 for improvements at the Detroit Lighthouse Depot, Mich. Materials are being purchased and proposals invited for constructing a new concrete wharf to replace the present timber structure. Upon completion of the wharf, the depot lamp shop will be extended and additional machinery installed. Amount expended to June 30, 1919, \$14,896.14.

TWELFTH DISTRICT.

White Shoal, Mich.—The act of March 4, 1907, appropriated \$250,000 for a light and fog-signal station at White Shoal, Mich., in the north end of Lake Michigan, to replace the White Shoal Light Vessel. The tower was completed and the light placed in commission September 1, 1910, and the fog signal on September 15, 1910. A submarine bell was established September 20, 1911, and later discontinued. A water-supply system was installed in October, 1911, and an oil-supply system in June, 1913. Riprap was placed about the station in August, 1914, and an auxiliary acetylene light for winter service was established in December of the same year. An allotment of \$1,900 has been made from the special appropriation for air hoists for the three boat cranes. Equipment for same has been purchased and will be installed this year. Amount expended to June 30, 1919, \$226,507.12.

Chicago Harbor, Ill.—The act of June 12, 1917, appropriated \$88,000 for the removal and rebuilding of Chicago Harbor Light Station on a new site at the south end of the north arm of the extension of the exterior breakwater, north side of Chicago Harbor; also for the establishment of two minor lights on the north and south ends of the south arm extension. This work has been completed except some interior finish and lining and installation of plumbing and heating plant in main structure, a concrete landing dock at the South Side Light and the erection of the South End Light, materials for which are on hand. This latter awaits completion of breakwater extension by the United States engineers. Work on these projects was discontinued in January, 1919, owing to exhaustion of funds. An additional appropriation will be required to complete this work. Amount expended to June 30, 1919, \$87,584.63.

Manitowoc Breakwater, Wis.—The act of June 12, 1917, appropriated \$21,000 for improving the light and fog-signal station at Manitowoc, Wis. The old frame structure has been removed from the site at the outer end of the north breakwater, new concrete substructure provided, and steel light and fog-signal station erected thereon. A light was installed in the new building on November 15, 1918. A steel switch house at shore end of breakwater has been erected, and 2,400 feet of conduit connecting it with the station is in place. Work remaining to be done consists in placing lining and interior finish, purchase of air-compressing plant, and installation of fog-signal apparatus and electric cable. Work was suspended owing to exhaustion of funds. An additional appropriation will be required to complete this project. Amount expended to June 30, 1919, \$20,823.53.

Indiana Harbor, Ind.—The act of June 12, 1917, appropriated \$100,000 for the establishment and improvement of aids to navigation at Indiana Harbor, Ind. A timber crib foundation with concrete capping will be placed this season by the United States engineers, upon which will be erected the light and fog-signal station. Two steel towers for minor lights on west breakwater and south pier are being purchased. Amount expended to June 30, 1919, \$28.

SIXTEENTH DISTRICT.

Ketchikan Lighthouse Depot, Alaska.—The act of July 1, 1918, appropriated \$90,000 for a lighthouse depot and the necessary equipment for the Sixteenth lighthouse district. The site has been cleared over the area to be occupied by warehouse, shops, etc. The wharf was 95 per cent completed on June 30, 1919. Cement, reinforcing steel, steel sash, and nearly all the other materials required in the erection of a two-story, reinforced-concrete warehouse have been purchased and are on the ground. The work is being done by day labor under a competent foreman. On June 30, 1919, the work had reached a degree of completion of approximately 35 per cent of the total improvements originally contemplated. Amount expended to June 30, 1919, \$48,589.95, or approximately 55 per cent of the total appropriation.

Aids to navigation, Alaska.—The act of June 12, 1917, appropriated \$60,000 for establishing and improving aids to navigation in Alaskan waters. During the fiscal year 1919 one gas and bell buoy and 8 acetylene lights were established from above appropriation. Amount expended to June 30, 1919, \$52,087.15.

SEVENTEENTH DISTRICT.

Aids to navigation, Coquille River, Oreg.—The act of July 1, 1916, appropriated \$6,000 for this project, which contemplated the removal of the light and fog signal to the south side of the entrance. Navigators and others having petitioned that no change be made in the establishment, no work has been done nor have any funds been expended during the year. Navigation interests desire that certain additional aids be provided at the entrance and a project is in course of preparation. Amount expended to June 30, 1919, \$36.34.

Aids to navigation, Wash. and Oreg.—The act of June 12, 1917, appropriated \$35,000 for new aids and improvements to existing aids. Under this appropriation four acetylene post lights and two oil-burning post lanterns have been established, two acetylene buoys have been constructed, one acetylene post light structure reconstructed, two new structures and outfits prepared ready for installation, and materials purchased for an electric installation at a light station now using incandescent oil vapor, and two new electric lights have been established. Amount expended to June 30, 1919, \$16,362.95.

EIGHTEENTH DISTRICT.

Point Vincente, Calif.—The act of July 1, 1916, appropriated \$80,000 for establishing a light and fog signal at Point Vincente, Calif. The site is under controversy, and the United States attorney prepared the data preliminary to entering suit for condemnation of suitable site; action has been deferred, and the condemnation suit has been postponed pending further negotiations with present owners. The date of completion will depend upon the acquisition of the site. Amount expended to June 30, 1919, \$13.50.

NINETEENTH DISTRICT.

Aids to navigation, Pearl Harbor, Hawaii.—The act of March 3, 1915, authorized \$80,000 for establishing aids in Pearl Harbor, which amount was appropriated by act of June 12, 1917. Location of aids determined and borings made. Privilege to occupy sites and lay necessary cable secured. System of lights satisfactory to the Navy Department has been approved. Plans and specifications of the proposed structures approved by the Bureau. Work will be advertised and bids received at an early date with the view of completing the structures by the close of the next fiscal year. Probable date of establishment, September 1, 1920. Amount expended to June 30, 1919, \$9,061.19.

**SAVING OF LIFE AND PROPERTY BY VESSELS OR EMPLOYEES OF THE
LIGHTHOUSE SERVICE DURING THE FISCAL YEAR 1919.**

District.	Vessel or employee rendering service.	Vessel, etc., aided.	Nature of assistance.
1st.....	J. M. Anderson, second assistant keeper, Cape Elizabeth Light Station, Me.	.....	Assisted 2 Coast Guard men in rescuing man from drowning.
	Tender Hibiscus.....	Schooner L.L.Hamlin.	Floated schooner which was aground, having run ashore during thick fog.
	C. E. B. Stanley, keeper, Indian Island Light Station, Me.	Yacht.....	Assisted in towing to a safe anchorage a yacht which had broken from her moorings.
	E. S. Farren, keeper, Eagle Island Light Station, Me.	.....do.....	Saved boat from being badly damaged or lost by hauling it off rocks.
	Harry Smith, keeper; Roscoe Chandler, first assistant keeper; Harry M. Kelley, second assistant keeper; Boon Island Light Station, Me.	Schooner Hazel E. Ritcey.	Rendered assistance to crew of 7 men from schooner which struck on rock near station and sank; furnished them with food and lodging.
	P. L. Marr, keeper; E. V. Talbot, assistant keeper; The Cuckolds Light Station, Me.	Yacht.....	Towed yacht off ledge near station.
	Tender Hibiscus.....	Schooner J. R. Penrose.	Hauled schooner off rocks at mouth of Kennebec River.
	.....do.....	Schooner Irene E. Meservey.	Towed schooner, partially dismantled, from position about 6 miles off Seguin Light Station, to anchorage in Boothbay Harbor, Me.
	Tender Zizania.....	Steamer Mary Jane..	Towed disabled steamer a distance of 3 miles to Peaks Island and landed several passengers, thence to Customhouse Wharf, Portland.
	W. F. Lurvey, keeper, Wood Island Light Station, Me.	Motor boat.....	Rendered assistance to 3 men in boat which had run onto the island.
2d.....	C. A. Baker, keeper, Butler Flats Light Station, Mass.	Sailboat.....	Rescued 3 men from capsized boat and towed boat to station.
	Tender Azalea.....	Steamer North Land.	Went alongside and took off 78 passengers and baggage and landed them at New Bedford, Mass., and assisted in transferring rest of passengers to steamer Uncatena.
	Tender Anemone.....	.....do.....	Found 3 tugs trying to pull ship from ledge. Ran hawser to ship's starboard quarter and pulled vessel from ledge.
	A. L. Payne, keeper, Bakers Island Light Station, Mass.	Passenger launch Melba.	Towed disabled launch, which was drifting toward rocks at Beverly, to Salem Willows.
3d.....	.....do.....	Motor boat.....	Towed to Manchester, Mass., disabled launch with 7 passengers aboard, which was drifting between House and Ram Islands.
	Geo. W. Denton, jr., keeper, Great Beds Light Station, N. J.	Rowboat.....	Took 2 men who were exhausted and cold to light station, and then to Perth Amboy.
	Tender Larkspur.....	Steamer Cervantes..	Assisted in controlling fire aboard steamer and in keeping burning oil from spreading over harbor.
	Mrs. Harvey D. Munn, daughter of late keeper F. M. Best, Hudson City Light Station, N. Y.	.....	Launched boat from station and rescued man and boy from drowning.
	Five-Fathom Bank Light Vessel No. 79, N. J.	Aeroplane.....	Went to assistance of disabled aeroplane, and took body of aviator, who was killed, and his companion aboard light vessel power boat, and also took plane in tow until relieved by naval vessel.
	Arden A. Penn, assistant keeper; Kiple A. Stryker, second assistant keeper; West Bank Light Station, N. Y.	Rowboat.....	Rendered assistance to disabled boat, with 2 men aboard, by towing it to station landing, and furnished men food and shelter.
	Wm. F. Petzolt, keeper, Stratford Point Light Station, Conn.	Motor boat.....	Furnished lubricating oil to disabled boat.
	Daniel F. McCourt, first assistant keeper; Robt. Wagoner, second assistant keeper; West Bank Light Station, N. Y.	Motor boat Adelaide.	Took disabled motor boat in tow and restored engine to working order.

SAVING OF LIFE AND PROPERTY BY VESSELS OR EMPLOYEES OF THE LIGHTHOUSE SERVICE DURING THE FISCAL YEAR 1919—Continued.

District.	Vessel or employee rendering service.	Vessel, etc., aided.	Nature of assistance.
3d.....	J. A. Davis, keeper, Saybrook Breakwater Light, Conn.	Launch.....	Took disabled launch and occupants to Lenwick Pier at Saybrook Point, where engine could be repaired.
	Otis L. Barstow, keeper, Mussel Beds Shoals Light, R. I.	Launch Kelley.....	Went to assistance of disabled launch, with 2 men aboard, and towed it to safety.
	J. A. Davis, keeper, Saybrook Breakwater Light, Conn.	.....	Rescued man from drowning and took him to station, where he was furnished dry clothing and food.
4th.....	Charles R. Manlove, keeper; John Colofen, additional first assistant keeper; Brandywine Shoal Light Station, Del.	Naval Patrol Boat No. 311.	Repaired disabled engine during storm and furnished 2 exhausted sailors food and shelter.
	Freddie C. Hill, keeper, Baker Range Light Station, Del.	.....	Rescued man who had fallen in ice near station and furnished him dry clothing and food after medical assistance had been rendered.
5th.....	Fenwick Island Shoal Light Vessel No. 52, Del.	Aeroplane.....	Rendered assistance to aeroplane and towed same to Lewes, Del.
	A. J. Simpson, keeper, Blakistone Light Station, Md.	Sailboat.....	Rescued sailboat, with 5 occupants, from a deep hole of whirlpools.
	H. C. Groome, keeper; Benjamin D. Preston, assistant keeper; Thimble Shoal Light Station, Va.	Motor boat.....	Rendered assistance to disabled motor boat with 6 occupants.
	C. A. Stirling, keeper, Craney Island Light Station, Va.	Gasoline launch.....	Rendered assistance to disabled launch with 2 occupants.
	G. M. Wible, keeper, Tangier Sound Light Station, Va.	Barge.....	Rendered assistance to barge grounded near the light station.
	S. B. Meekins, assistant keeper, North River Light Station, N. C.	Motor boats.....	Rendered assistance to 2 motor boats that were aground.
	R. H. Mathews, assistant keeper, Deep Water Shoals Light Station, Va.	Sailboat.....	Rescued 4 soldiers adrift in a sail boat during a storm.
	Charles N. Pugh, keeper, Roanoke Marshes Light Station, N. C.	Steamer Hattie Creef	Assisted captain and engineer in boarding steamer which had broken from her moorings during a storm.
	I. C. Meekins, keeper, Croatan Light Station, N. C.	.....	Rescued woman from drowning and assisted in rescuing 3 other persons.
	John E. Morgan, second assistant keeper, Wolf Trap Light Station, Va.	Aeroplane.....	Rendered assistance to aeroplane containing 3 occupants.
	Charles A. Larsen, keeper, James A. Downs, assistant keeper; Ragged Point Light Station, Md.	Barge L. B. Adams..	Rendered assistance to barge which had sprung a leak.
	William McDorman, assistant keeper, Great Shoals Light Station, Md.	Boat.....	Assistance rendered officer and men of Aviation Corps.
	James O. Casey, keeper, Southwest Point Royal Shoal Light Station, N. C.	.....	Supplied provisions to keeper of Brant Island Shoal Light Station, who was without assistance.
	Tender Arbutus.....	U. S. S. Saranac.....	Assisted in extinguishing fire and in leading vessel to deep water.
	G. M. Willis, sr., keeper, Point Lookout Light Station, Md.	Schooner Sodonla Curley.	Assisted captain of schooner in storing property of beached schooner in lighthouse barn.
	Tender Arbutus.....	Gasoline boat.....	Rendered assistance to gasoline boat during a storm.
	W. G. Rollinson, keeper, Hatteras Light Station, N. C.	Motor boat; U. S. mail boat.	Rendered assistance to disabled motor boat containing 2 men, and floated U. S. mail boat with 5 men aboard.
	Tender Arbutus.....	Motor boat.....	Rendered assistance to disabled motor boat containing 2 men.
	William Yeatman, keeper, Drum Point Light Station, Md.	Aeroplane.....	Assistance rendered disabled aeroplane containing 2 officers.
	C. C. Midgett, assistant keeper, Croatan Light Station, N. C.	Motor boat.....	Rendered assistance to disabled motor boat with one occupant aboard.
	W. J. Tate, keeper, North Landing River Aids, etc., N. C.	Launch.....	Assistance rendered disabled launch with 2 occupants.
	William McDorman, keeper; Gary E. Powell, assistant keeper; Great Shoals Light Station, Md.	Skiff Robert L. Webster.	Rescued skiff, which was adrift and notified owner.
	L. V. Gaskill, keeper; T. S. Twiford, assistant keeper; Craighill Front Range Light Station, Md.	Launch.....	Took in tow a disabled launch with 3 men aboard.

SAVING OF LIFE AND PROPERTY BY VESSELS OR EMPLOYEES OF THE LIGHTHOUSE SERVICE DURING THE FISCAL YEAR 1919—Continued.

District.	Vessel or employee rendering service.	Vessel, etc., aided.	Nature of assistance.
6th.....	Relief Light Vessel No. 53.....	Navy S. P. No. 923..	Towed disabled patrol boat with light-vessel power boat from Brunswick Light Vessel station to Brunswick, Ga.
	Tender Cypress.....	S. S. Bedminster, U. S. Shipping Board.	Rendered assistance to steamer stranded off Sapelo Sound, Ga. Officers and crew consisting of 35 men were taken to Charleston, S. C. Tender returned to steamer, but was unable to pull it off the shoal.
	.....do.....	.....	Assisted in extinguishing fire on piers at water front, Charleston, S. C.
	John Lindquist, keeper; Wm. T. Lindquist, second assistant keeper; Mosquito Inlet Light Station, Fla.	S. S. Maple, of Miami S. S. Co.	Assisted in supplying provisions and coal to steamer anchored about 2 miles offshore from light station.
	K. E. Kremser, keeper, Georgetown Light Station, S. C.	Aeroplane.....	Rendered assistance to aeroplane with 6 occupants.
	Thomas Knight, keeper, Hillsboro Inlet Light Station, Fla.	Hydroplane.....	Towed disabled hydroplane, with 3 occupants aboard, to light station.
	.....do.....	.....do.....	Rendered assistance to hydroplane with 2 occupants aboard.
	.....do.....	Schooner Florence Harvey.	Supplied water to schooner anchored off light station.
	.....do.....	Hydroplane.....	Towed disabled hydroplane, with 2 occupants, from beach to S. C. 334.
	Thomas Knight, keeper; C. Malloy, first assistant keeper; Hillsboro Inlet Light Station, Fla.	.....do.....	Towed disabled hydroplane with 2 occupants to light station.
	Thomas Knight, keeper, Hillsboro Inlet Light Station, Fla.	.....do.....	Assisted in floating and repairing hydroplane.
	Thomas Knight, keeper; R. Heisser, first assistant keeper; and R. Nivens, second assistant keeper; Hillsboro Inlet Light Station, Fla.	Motor boat Nightingale.	Floated abandoned motor boat which was filled with water and sand, towed her inside and delivered to owners.
7th.....	T. A. Moody, keeper, Anclothe Keys Light Station, Fla.	Sloop, boat, and schooner.	Rescued 2 men from capsized sloop; towed to safe anchorage a disabled sponge-divers' boat with 2 men in it who were without food or water; and towed to Anclothe anchorage a schooner which was lying 6 miles offshore in a disabled condition.
	Richard C. Roberts, first assistant keeper, Alligator Reef Light Station, Fla.	Seaplane.....	Went to assistance of disabled seaplane which had fallen in the water about 10 miles from the light station, dived into shark-infested waters to locate 2 men reported on top or inside of plane, then towed plane about 4 miles when it was taken in tow by a naval boat.
8th.....	Chas. Johnson, keeper; Robert J. Fine, second assistant keeper; Dry Tortugas Light Station, Fla.	Schooner Curry.....	Pulled schooner off rock with station motor boat and towed it to Garden Key (Fort Jefferson).
	Gilbert S. Bell, mechanic; Robert S. Haskins, laborer; Albert Taylor, assistant keeper; Louis Imsand, mechanic; John B. Cazalas, blacksmith; Jas. M. Jones, blacksmith's helper; E. E. Hanson, laborer; and Dan Callaway, foreman.	.....	Assisted in extinguishing fire in buoy shed at Mobile Lighthouse Depot, Ala., which threatened to destroy depot and stock.
	William Hill, keeper, Calcasieu Range Light Station, La.	.....	Replaced range light during hurricane and cared for family in vicinity of station whose dwelling had been unroofed by the storm.
	Richard F. Steen, keeper, Cat Island Light Station, Miss.	Navy cutter.....	Rendered assistance to 3 students of Gulf Coast Military Academy, adrift in a Navy cutter; furnished them food and shelter and took them back to the academy.

SAVING OF LIFE AND PROPERTY BY VESSELS OR EMPLOYEES OF THE LIGHTHOUSE SERVICE DURING THE FISCAL YEAR 1919—Continued.

District.	Vessel or employee rendering service.	Vessel, etc., aided.	Nature of assistance.
8th.....	Peter Clarisse, keeper, Ship Island Light Station, Miss.	Naval cutter boat...	Rendered assistance to 10 recruits from naval station at Gulfport whose boat was blown out to sea during a gale; furnished them shelter at the light station; telephoned naval station for a motor boat to take them back to the naval station.
	George W. Bardwell, keeper, Galveston Jetty Light Station, Tex.	Launch Patsy.....	Rendered assistance to 4 men in disabled launch; towed them to life-saving station at Fort Point.
	Niels Nilsen, keeper, Pascagoula River Entrance Lights, Miss., and Frank P. Spratley, keeper, Horn Island Light Station, Miss.	Launch Dixie.....	Towed disabled launch from Horn Island Light Station to Pascagoula River Entrance Lights, where the owner and his wife were furnished food and shelter and the launch placed in running order.
	George W. Anderson, keeper, Half-moon Reef Light Station, Tex.	Launch Oma B.....	Rendered assistance to captain of schooner which had stranded near the light station during a gale, and furnished him provisions.
	Tender Sunflower.....	Navy tug Barnett...	Endeavored to float tug stranded on east bank of Mississippi River.
	Launch No. 130.....	Schooner Bertie.....	Assisted in floating schooner which was ashore on a reef at the entrance to Bayou Lacombe, Lake Pontchartrain, La.
	Milton E. Wheelock, keeper, Crooked River Range Light Station, Fla.	Motor launch.....	Towed disabled launch, with 2 men, 3 women, and 3 children aboard, to light station and furnished food and shelter to women and children.
9th.....	Tender Lilac.....	S. S. Balosoro, U. S. Shipping Board.	Towed steamer with valuable cargo aboard from anchorage in open sea to safe anchorage in St. Thomas Harbor, Virgin Islands.
	.....do.....	Barge.....	Rescued barge adrift in San Juan Harbor and moored it at the lighthouse dock, it then being turned over to owners.
	Keepers of Mona Island Light Station, P. R.	Schooner.....	Assisted in saving schooner and crew.
10th.....	Geo. H. Ward, keeper, Sacketts Harbor Light Station, N. Y.	Power boat.....	Assisted occupants of boat which struck rocks and sank and brought women and children safely ashore.
	Tender Crocus.....	Gasoline launch Graciel II.	Recovered launch partly submerged in Lake Erie and delivered it to representative of owner.
	Robert C. Graves, keeper; Willie E. Frazier, assistant keeper; Galloo Island Light Station, N. Y.	Power boat Louis Donald.	Towed disabled boat to lighthouse dock and furnished food and shelter to 4 men.
	Robert Allen, keeper; Patrick Owens, first assistant keeper; Frank Huntington, second assistant keeper; Presque Isle Pierhead Light Station, Pa. (and wives of Allen and Huntington).	Steamer Tempest, Lawrence S. S. Co., owners.	Assisted in rescue of crew of steamer which foundered in channel off Erie Harbor, Pa.
11th.....	O. J. Louks, first assistant keeper, Middle Island Light Station, Mich.	Yacht Companion...	Took 3 of 15 men on board stranded yacht to coast guard station and reported wreck.
	W. A. Burke, keeper, Saginaw River Range Light Station, Mich.	Motor boat Patrice..	Took party off stranded boat and floated it next day.
	Michael Nolan second assistant keeper, Huron Island Light Station, Mich.	Steamer Vulcan.....	Took an officer off stranded vessel to report accident and then returned and aided in getting under control a fire which had started on the steamer.
12th.....	H. Rocheleau, second assistant keeper, Holland Range Light Station, Mich.	Canoe.....	Rescued 2 persons from capsized canoe and placed them ashore.
	L. Belounga, keeper; A. Keller, second assistant keeper; Ile Aux Galets Light Station, Mich.	Motor boat attached to Squaw Island Light Station, Mich.	Rendered assistance to occupant of disabled boat and provided sail for return to home station.

SAVING OF LIFE AND PROPERTY BY VESSELS OR EMPLOYEES OF THE LIGHTHOUSE SERVICE DURING THE FISCAL YEAR 1919—Continued.

District.	Vessel or employee rendering service.	Vessel, etc., aided.	Nature of assistance.
12th.....	L. Beloungea, keeper; F. Lauer, first assistant keeper; Ile Aux Galets Light Station, Mich.	Motor boat.....	Towed disabled boat containing 3 men to station.
	L. Beloungea, keeper; F. Lauer, first assistant keeper; A. Keller, second assistant keeper; Ile Aux Galets Light Station, Mich.	.....do.....	Towed disabled boat about 1 mile to station and afterwards towed it to mainland.
	Peshtigo Reef Light Vessel No. 77, Wis.	Motor boat Wyandotte.	Rendered assistance to boat with 5 persons aboard and provided temporary rudder for steering to port.
	Mrs. Ross F. Wright, wife of first assistant keeper, Manitowoc Light Station, Wis.	.....	Rescued 2 bathers from drowning.
	Jas. McCormick, keeper; W. F. Green, first assistant keeper; O. E. Dame, second assistant keeper, South Fox Island Light Station, Mich.	Motor boat Fountain Bros.	Towed disabled boat about 3 miles to station and assisted in repairing propeller.
	O. C. McCauley, keeper; Thos. Gatliff, second assistant keeper, Squaw Island Light Station, Mich.	Fishing tug Lillie and May.	Towed disabled vessel about 4 miles to station.
	C. J. Graan, keeper; J. E. Muckian, first assistant keeper; Calumet Pierhead Light Station, Ill.	U. S. Engineer Department motor boat.	Assisted in extinguishing fire on board boat.
	W. Ottosen, keeper, Pilot Island Light Station, Wis.	Fish boat Edna.....	Towed disabled boat to station and assisted in repairing engine.
	J. Napiezinski, keeper, Manitowoc Light Station, Wis.	.....	Assisted in search for body of drowned girl under severe weather conditions.
	C. Witzmann, keeper; A. Weber, first assistant keeper, Tail Point Light Station, Wis.	Motor boat G. F. Laviolette.	Rescued 3 men from raft on which they had taken refuge after vessel had capsized and sunk.
	L. Hutzler, keeper, Grassy Island Light Station, Wis.	.....do.....	Assisted in salvaging portion of cargo after vessel had capsized and sunk.
13th.....	Tender Dandelion.....	Steamer St. Paul.....	Rendered assistance in getting steamer off of sand bar.
	.....do.....	Steamer Ellen, U. S. Engineer Department.	Assisted in raising steamer which sank at the head of Coon Slough, Upper Mississippi River.
16th.....	W. A. Shoemaker, keeper, Cape Hinchinbrook Light Station, Alaska.	Gas boat Myrtle H..	Furnished food and shelter to 3 shipwrecked men for 9 days.
	George West, keeper, Guard Island Light Station, Alaska.	Gas boat Loey B....	Towed disabled boat, which was in danger of drifting on rocks, to safe anchorage for repairs.
	Tender Cedar.....	Steamer Princess Sophia.	Rendered assistance when vessel was wrecked on Vanderbilt Reef, doing patrol work, transporting searching parties, using wireless, etc.
17th.....	Tender Heather.....	Launch May.....	Towed to Port Townsend, Wash., disabled launch and took man on board tender and cared for him.
	Tender Heather and Swiftsure Bank Light Vessel No. 93, Wash.	Boat.....	While coaling light vessel, cargo boat of tender Heather capsized; prompt action of officers of both vessels resulted in all 7 of crew being saved.
18th.....	A. C. Anderson, keeper, Santa Cruz Light Station, Calif.	.....	Attempted to rescue drowning man and finally recovered body.
	J. Rankin, keeper, Fort Point Light Station, Calif.	.....	Rescued 2 boys from drowning.
	W. H. Hicks, keeper Mile Rocks Light Station, Calif.	.....	Rescued from drowning 3 men whose canoe capsized near the station.
19th.....	Tender Kukul.....	Schooner Ida May ...	Towed disabled schooner into harbor.
	.....do.....	Steamer Santa Cruz.	Pulled stranded steamer off of reef in Honolulu Harbor.
	.....do.....	Steamer Cathana....	Assisted in floating steamer which had grounded on Sand Island, Honolulu Harbor.
	Manuel Ferriera, keeper, Barbers Point Light Station, Hawaii.	Fishing sampan.....	Furnished shelter, dry clothing, and food to 7 persons from shipwrecked sampan.
	Tender Kukul.....	Schooner Kitsap....	Searched for schooner wrecked by collision, located derelict, and assisted in destroying same.

DAMAGE BY COLLISIONS.

During the fiscal year there were 28 cases of collisions by vessels with aids to navigation, tenders and other lighthouse property, causing damages which have been repaired or paid for by the parties responsible therefor, or proper measures taken by the Lighthouse Service to compel payment by owners of the vessels where such owners or vessels were identified.

During the fiscal year there were three cases of collisions, in which vessels of the Lighthouse Service were found to have been responsible for damage to other vessels or property. Adjustment of claims resulting from these collisions, in the total amount of \$160.37, has been made and report submitted to Congress under the provisions of section 4 of the act of June 17, 1910 (36 Stat. 537).

PUBLICATIONS OF THE LIGHTHOUSE SERVICE.

Publications.	Date of last edition.	Cost of last edition.	Number distributed.
Light lists:			
Atlantic and Gulf coasts of United States.....	Jan. 1, 1919	\$3,890	11,799
Pacific coast of United States, etc.....	do.	840	2,504
Great Lakes of United States and Canada.....	Apr. 1, 1919	876	1,383
Upper Mississippi River and tributaries.....	Jan. 15, 1919	215	1,206
Ohio River and tributaries.....	Sept. 15, 1918	166	1,051
Lower Mississippi River and tributaries.....	Nov. 15, 1918	129	1,500
Buoy lists:			
First district.....	May 1, 1918	888	1,971
Second district.....	June 1, 1918	757	2,128
Third district.....	May 15, 1919	954	5,776
Fourth district.....	June 1, 1919	271	1,160
Fifth district.....	May 15, 1919	1,104	1,175
Sixth district.....	May 1, 1918	387	1,205
Seventh district.....	do.	474	1,166
Eighth district.....	Sept. 1, 1918	653	3,809
Ninth district.....	Nov. 15, 1918	61	2,105
Tenth district.....	Apr. 1, 1919	276	1,372
Eleventh district.....	do.	592	1,369
Twelfth district.....	do.	325	1,356
Sixteenth district.....	June 1, 1919	255	195
Seventeenth district.....	do.	301	551
Eighteenth district.....	June 1, 1918	229	.....
Nineteenth district.....	Feb. 1, 1919	128	934
Miscellaneous publications:			
Weekly Notice to Mariners.....	1919	3,849	244,450
Annual Report, Commissioner of Lighthouses.....	1918	612	1,411
Regulations for the United States Lighthouse Service.....	1918	619	448
Medical handbook.....	1915	683	12
Lighthouse Service bulletins.....	1919	218	1,800
Regulations for lighting bridges.....	1915	202	89
Regulations for uniforms.....	1912	70	4
Civil-service regulations.....	1913	73	178
Instructions for cost keeping.....	1914	120	1
Instructions to employees.....	1915	408	20
The United States Lighthouse Service.....	1915	508	137

COST OF PRINTING FOR THE LIGHTHOUSE SERVICE DURING THE FISCAL YEAR 1919.

Light lists.....	\$5,157.66
Buoy lists.....	4,150.58
Notices to mariners.....	3,706.17
Annual report.....	612.15
Specifications and other publications.....	714.36
Forms, reports, record books, etc.....	251.51
Total.....	14,592.43

MISCELLANEOUS RECEIPTS.

The following amounts were received by the Lighthouse Service during the year and turned into the Treasury: From sales of property, \$25,794.40; from damages to aids to navigation and other property, \$3,799.30; from leases and rentals, \$5,688.80.

APPROPRIATIONS FOR THE BUREAU OF LIGHTHOUSES AND THE LIGHTHOUSE SERVICE, SIXTY-FIFTH CONGRESS, THIRD SESSION, 1918-19, AND SIXTY-SIXTH CONGRESS, FIRST SESSION.

Title.	Act.	Amount.
Maintenance:		
Salaries of keepers of lighthouses, 1919.....	Deficiency, Nov. 4, 1918.....	\$254,432
Retired pay, Lighthouse Service, 1919.....	do.....	30,000
Salaries, Bureau of Lighthouses, 1920.....	Legislative, Mar. 1, 1919.....	65,430
General expenses, Lighthouse Service, 1920.....	Sundry civil, July 19, 1919.....	3,500,000
Salaries of keepers of lighthouses, 1920.....	do.....	1,300,000
Salaries, lighthouse vessels, 1920.....	do.....	1,400,000
Salaries, Lighthouse Service, 1920.....	do.....	380,000
Retired pay, Lighthouse Service, 1920.....	do.....	45,000
Total for maintenance.....		6,974,862
Special works:		
Fifth lighthouse district, gas buoys.....	Deficiency, Nov. 4, 1918.....	60,000
Aids to navigation, St. Marys River, Mich.....	do.....	80,000
Repairing and rebuilding aids to navigation, Atlantic coast.....	do.....	300,000
Extension Rocks Light Station, N. Y.....	Sundry civil, July 1, 1919.....	10,000
Staten Island Lighthouse Depot, N. Y. (machine shop).....	do.....	30,000
Riprap protection for light stations, third lighthouse district.....	do.....	150,000
Point Jiguero Light Station, P. R.....	do.....	24,000
Manitowoc Breakwater Light Station, Wis.....	do.....	9,000
Chicago Harbor Light Station, Ill.....	do.....	6,400
Aids to navigation, Alaska.....	do.....	75,000
Lightkeepers' dwellings.....	do.....	50,000
Total for special works.....		794,400
Grand total.....		7,769,262

NOTE.—In addition to the above appropriations, the Navy Department transferred \$539,279 to the credit of "General expenses, Lighthouse Service, 1919," and \$200,000 to the credit of "Salaries, lighthouse vessels, 1919," and \$9,000 to the credit of "Staten Island Lighthouse Depot, N. Y." Allotments were made by the President from the fund for "National security and defense" of \$175,000, and \$100,000 for Staten Island Lighthouse Depot, N. Y., and aids to navigation, Caribbean Sea, respectively.

EXPENDITURES DURING THE FISCAL YEAR 1919 FROM APPROPRIATIONS FOR THE LIGHTHOUSE SERVICE.

[Obligations incurred are not included.]

Salaries:	
Bureau of Lighthouses, 1918.....	\$2,792.98
Bureau of Lighthouses, 1919.....	53,839.12
Salaries of keepers of lighthouses:	
1918.....	26,192.88
1919.....	1,113,110.54
Salaries, lighthouse vessels:	
1918.....	55,649.90
1919.....	1,353,243.55
Salaries, Lighthouse Service:	
1917.....	20.00
1918.....	4,128.38
1919.....	363,520.43
General expenses, Lighthouse Service:	
1917.....	66,368.56
1918.....	704,218.59
1919.....	2,551,038.58
Increase of compensation, Department of Commerce:	
1918.....	7,851.10
1919.....	371,575.64
Retired pay, Lighthouse Service:	
1919.....	20,987.65
Total maintenance.....	6,694,537.90

SPECIAL WORKS.

General:	
Repairing and rebuilding aids to navigation, Atlantic coast.....	130,425.93
Light vessels for general service.....	80,536.58
Lighthouse tender, general service.....	250.07
Radio installations on lighthouse tenders.....	3,041.87
Oil houses for light stations.....	464.03

First district:	
Dog Island Light, Me.....	\$3, 111. 89
Second district:	
Woods Hole Lighthouse Depot, Mass.....	1, 270. 21
Nantucket Harbor Fog Signal, Mass.....	5, 025. 53
Third district:	
Staten Island Lighthouse Depot, N. Y. (office).....	7, 847. 12
Staten Island Lighthouse Depot, N. Y. (wharves).....	33, 777. 28
Staten Island Lighthouse Depot, N. Y. (Bureau of Yards and Docks)	9, 000. 00
Aids to navigation, Hudson River, N. Y.....	80, 453. 91
Aids to navigation, East River, N. Y.....	6, 603. 18
Tender for third lighthouse district.....	5. 40
Great Salt Pond Light Station, R. I.....	16. 62
National security and defense, Department of Commerce, 1919 (Tompkinsville).....	16, 635. 85
Fourth district:	
Aids to navigation, Delaware River, Pa. and Del.....	9, 660. 49
Joe Flagger Shoal Light Station, Delaware River.....	7, 926. 04
Fifth district:	
Thimble Shoal Light Station, Va.....	725. 00
Aids to navigation, Chesapeake Bay, Md. and Va.....	1, 201. 80
Aids to navigation, Cape Charles City, Va.....	3, 524. 00
Fifth lighthouse district, gas buoys.....	39, 695. 23
Sixth district:	
Tender for engineer, sixth lighthouse district.....	562. 68
Aids to navigation, St. Johns River, Fla.....	7, 699. 12
Eighth district:	
Aransas Pass Light Station, Tex.....	10, 445. 20
Galveston Jetty Light Station, Tex.....	315. 00
Aids to navigation, Atchafalaya Entrance Channel, La.....	4, 476. 72
Repairing and rebuilding aids to navigation, Gulf of Mexico.....	63, 030. 99
Aids to navigation, Mississippi River, La.....	18, 090. 50
National security and defense, Department of Commerce, 1919 (Caribbean Sea).....	14, 380. 38
Ninth district:	
Navassa Island Light Station, West Indies.....	151. 62
Point Borinquen Light Station, P. R.....	501. 33
Tenth district:	
Aids to navigation, Ashtabula Harbor, Ohio.....	550. 20
Aids to navigation, Lorain Harbor, Ohio.....	2, 530. 83
Aids to navigation, Conneaut Harbor, Ohio.....	18, 309. 04
Aids to navigation, Toledo Harbor, Ohio.....	321. 41
Aids to navigation, Fairport Harbor, Ohio.....	995. 00
Aids to navigation, Huron Harbor, Ohio.....	3, 509. 76
Eleventh district:	
Aids to navigation, Fighting Island Channel, Detroit River, Mich..	4, 859. 40
Detroit River Lights, Mich.....	13. 70
Superior Pierhead Range Lights, Wis.....	1, 837. 00
Sand Hills Light Station, Mich.....	45, 328. 72
Aids to navigation, Keweenaw Waterway, Mich.....	57, 169. 72
Detroit Lighthouse Depot, Mich.....	14, 879. 07
Aids to navigation, St. Mary's River, Mich.....	1, 225. 16
Twelfth district:	
White Shoal Light Station, Lake Michigan.....	545. 55
Chicago Harbor Light Station, Ill.....	32, 818. 49
Manitowoc Breakwater Light Station, Wis.....	19, 859. 30
Sixteenth district:	
Aids to navigation, Alaska.....	11, 778. 28
Cape St. Elias Light Station, Alaska.....	103. 20
Depot for sixteenth lighthouse district.....	48, 589. 95
Seventeenth district:	
Aids to navigation, Puget Sound, Wash.....	\$783. 83
Kellett Bluff Light Station, Wash.....	35, 371. 60
Aids to navigation, Wash. and Oreg.....	16, 111. 30

Nineteenth district:

Aids to navigation, Pearl Harbor, Hawaii..... \$7,741.91

Total, special works..... 880,958.40

Total, maintenance appropriations..... 6,694,537.90

Total, special works..... 880,958.40

Grand total..... 7,575,496.30

ITEMIZED ESTIMATES OF APPROPRIATIONS FOR THE FISCAL YEAR 1921, AND ITEMIZED STATEMENT OF EXPENDITURES FOR THE FISCAL YEAR 1919, AS REQUIRED BY THE ACT OF CONGRESS APPROVED JUNE 25, 1910 (36 STAT., 755).

[The expenditures herein stated are in part estimated, owing to the fact that all obligations incurred for the year 1919 have not yet been settled. Articles of supplies purchased for general stock have also been distributed, approximately, to features to be benefited. This table refers to appropriations made in the sundry civil appropriation act and does not include Bureau salaries in Washington nor the cost of publications, otherwise provided for. This statement contains also amounts for salaries and wages under certain items which are shown separately in the Book of Estimates, 1921.]

Item.	Estimate, 1921.	Expenditures, 1919.	Item.	Estimate, 1921.	Expenditures, 1919.
GENERAL EXPENSES, LIGHTHOUSE SERVICE.			GENERAL EXPENSES, LIGHTHOUSE SERVICE--continued.		
Lights and fog signals:			Offices--Continued.		
Rations and provisions.....	\$248,700	\$247,757	Stationery and office supplies.....	\$40,000	\$50,225
Fuel and rent for keepers.....	84,000	82,230	Telegraph and telephone.....	8,000	7,830
General supplies.....	300,000	290,903	Traveling expenses and mileage.....	30,000	28,304
Repairs and improvements, including grounds and outbuildings.....	400,000	394,973	Rent.....	3,000	2,750
Establishing lights and fog signals, including sites.....	35,000	18,946	Freight, expressage, and cartage.....	95,000	96,930
Necessary additional land for light stations.....	1,500		Incidental expenses.....	7,000	8,250
Oil and carbide houses.....	2,500	1,227	Total.....	1,300,000	1,125,411
Incidental expenses.....	15,000	21,071	Appropriation, 1920, \$3,500,000		
Daymarks and spindles:			Appropriation, 1919, \$3,500,000		
Establishment, including sites.....	4,000	3,521	SALARIES OF KEEPERS OF LIGHTHOUSES.		
Repairs and improvements.....	2,500	1,349	Salaries of lighthouse keepers.....	1,330,000	1,147,806
Incidental expenses.....	600	571	Appropriation, 1920, \$1,300,000		
Post lights:			Appropriation, 1919, \$1,194,432		
Establishment.....	2,000	1,228	SALARIES, LIGHTHOUSE VESSELS.		
Wages of laborers attending lights.....	260,000	248,184	Salaries and wages, lighthouse tenders.....	1,310,829	882,266
Supplies.....	40,000	39,221	Salaries and wages, light vessels.....	789,171	531,715
Repairs and improvements.....	15,000	11,822	Total.....	2,100,000	1,413,975
Incidental expenses.....	2,200	2,507	Appropriation, 1920, \$1,400,000		
Buoys:			Appropriation, 1919, \$1,265,000		
Establishment.....	200,000	190,010	SALARIES, LIGHTHOUSE SERVICE.		
Supplies.....	65,000	64,176	Salaries, authorized district office, technical and depot forces.....	490,000	368,012
Repairs.....	75,000	78,953	Appropriation, 1920, \$380,000		
Incidental expenses.....	4,000	1,227	Appropriation, 1919, \$380,000		
Tenders:					
Rations and provisions.....	300,000	289,125			
Supplies.....	625,000	609,563			
Repairs.....	550,000	493,504			
Incidental expenses.....	18,000	26,749			
Light vessels:					
Rations and provisions.....	155,000	143,807			
Supplies.....	160,000	151,168			
Repairs.....	275,000	252,211			
Incidental expenses.....	6,000	6,359			
Depots:					
Pay of laborers and mechanics.....	90,000	82,451			
Rent.....	5,500	5,120			
Supplies.....	70,000	65,349			
Repairs and improvements.....	90,000	77,277			
Incidental expenses.....	15,000	22,110			
Offices:					
Technical books and periodicals.....	500	335			

NOTE.—The expenditures shown include reimbursements from Navy Department for part of maintenance expenses of vessels and stations transferred temporarily to Navy by Executive order, approximately \$625,441, under appropriation "General expenses, Lighthouse Service," and \$148,975 under appropriation, "Salaries, Lighthouse Service." Under appropriation "General expenses, Lighthouse Service," it is proposed during the fiscal year 1920 to authorize per diem in lieu of subsistence, pursuant to the act of Aug. 1, 1914, at rates of from \$2 to \$4.

Group 2—Continued.

32. Port Real, P. R., establishment of light station.....	\$40,000.00
33. Nine Mile Point, Mich., establishment of light and fog-signal station.....	50,000.00
34. Grays Harbor Light Station, Wash., improvements.....	20,000.00
35. Alaska, aids to navigation.....	75,000.00
36. Lake Champlain, N. Y. and Vt., improvements.....	150,000.00
37. Sag Harbor, N. Y., improvements.....	45,700.00
38. Alaska, improvements.....	77,000.00
39. Depot for second lighthouse district.....	123,645.00
40. Great Salt Pond Light Station, R. I., to complete.....	53,000.00
41. Norfolk, Va., to Beaufort, N. C., aids to navigation.....	63,000.00
42. Fairport Harbor, Ohio, aids to navigation.....	35,500.00
43. Lansing Shoal, Mich., establishment of light and fog-signal station.....	304,000.00
44. Two Rivers, Wis., improvements.....	6,000.00
Total, group 2 (not included in total of estimates).....	1,377,745.00

RECAPITULATION.

For general maintenance of the Lighthouse Service.....	8,384,668.40
For special works: Group 1.....	7,989,500.00
Total.....	17,751,913.40

DETAILED ESTIMATES FOR MAINTENANCE, 1921.

BUREAU OF LIGHTHOUSES.

Salaries.....	\$79,668.40
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GENERAL EXPENSES, LIGHTHOUSE SERVICE.

For supplies, repairs, maintenance, and incidental expenses of lighthouses and other lights, beacons, buoyage, fog signals, lighting of rivers heretofore authorized to be lighted, light vessels, other aids to navigation, and lighthouse tenders, including the establishment, repair, and improvement of beacons and day marks and purchase of land for same; the establishment of post lights, buoys, submarine signals, and fog signals; the establishment of oil or carbide houses not to exceed \$10,000: *Provided*, That any oil or carbide house erected hereunder shall not exceed \$550 in cost; the construction of necessary outbuildings at a cost not exceeding \$500 at any one light station in any fiscal year; the improvements of grounds and buildings connected with light stations and depots; restoring light stations and depots and buildings connected therewith: *Provided*, That such restoration shall be limited to the original purpose of the structures; wages of persons attending post lights; pay of temporary employees and field force while engaged on works of general repairs and maintenance and pay of laborers and mechanics at lighthouse depots; rations and provisions or commutation thereof for keepers of lighthouses, working parties in the field, officers and crews of light vessels and tenders, and officials and other authorized persons of the Lighthouse Service on duty on board of such tenders or vessels; and money accruing from commutation for rations and provisions for the above-named persons on board of tenders and light vessels or in working parties in the field may be paid on proper vouchers to the person having charge of the mess of such vessel or party, reimbursement under rules prescribed by the Secretary of Commerce of keepers of light stations and masters of light vessels and of lighthouse tenders for rations and provisions and clothing furnished shipwrecked persons who may be temporarily provided for by them, not exceeding in all \$5,000 in any fiscal year; fuel and rent of quarters where necessary for keepers of lighthouses; the purchase of land sites for fog signals; the rent of necessary ground for all such lights and beacons as are for temporary use or to mark changeable channels and which in consequence can not be made permanent; the rent of offices, depots, and wharves; traveling expenses, mileage, library books for light stations and vessels, and technical books and periodicals not exceeding \$1,000; traveling and subsistence expenses of teachers while actually employed by States or private persons to instruct the children of keepers of lighthouses; and for all other contingent expenses of district offices and depots and not exceeding \$8,500 for contingent expenses of the Office of the Bureau of Lighthouses in the District of Columbia, \$4,300,000.

Hereafter the benefits of the Public Health Service accorded to light keepers and assistant light keepers of the Lighthouse Service under the provisions of the act of

August 28, 1916 (39 Stat., 538), shall also include medical relief without charge to such employees at other than hospitals or stations of the Public Health Service, under regulations promulgated by the Secretary of the Treasury and the Secretary of Commerce.

Hereafter post-lantern lights and other aids to navigation may be established and maintained, in the discretion of the Commissioner of Lighthouses, out of the annual appropriations for the Lighthouse Service on the Yukon River and its tributaries, Alaska.

Hereafter the benefits of section 6 of the act of June 20, 1918 (40 Stat., 608), providing for the retirement of officers and employees of the Lighthouse Service, shall be available, under rules prescribed by the Secretary of Commerce, at the same rate of compensation as provided in said act, for the same classes of officers and employees of the Lighthouse Service, who by reason of disability incident to their work and not the result of their own vicious habits have lost their efficiency for active work before reaching the age or having the length of service required by existing law.

Hereafter the Commissioner of Lighthouses, subject to the approval of the Secretary of Commerce, is authorized to consider, ascertain, adjust, and determine all claims for loss or damage, where the amount of the claim does not exceed \$500, to the personal property of officers and employees of the Lighthouse Service hereafter occasioned by storm, fire, shipwreck, or other extraordinary cause, not due to the negligence or voluntary act of the owner of such property, and report the amounts so ascertained and determined to be due the claimants to Congress at each session thereof through the Treasury Department for payment as legal claims out of appropriations that may be made by Congress therefor; provided that the property is lost or damaged at stations, depots, or on vessels of the Lighthouse Service, or in transit by reason of the official duties of such persons.

NOTE.—The amount estimated for is \$800,000 in excess of the appropriation for the fiscal year 1920, made necessary on account of the general expansion of the Service and the great advance in the cost of all commodities and services.

An increase of appropriation is considered necessary because of the extraordinary advance in the price of labor and materials, on account of the increase in numbers of aids required for the safety of navigation, and to keep the Lighthouse Service in an economical state of repair and efficiency. The total number of aids was increased in 1919 from 15,076 to 16,076, an increase of 400, or 2.6 per cent. In order to keep pace with the constant development of commerce proper provision for maintenance and repair as well as for the establishment of necessary additional minor aids frequently requested by mariners should be made. It has been found necessary to estimate on an increase for all items in the appropriations covering the purchase of supplies and materials, due to the continued steady general advance in prices. The additional amount requested is conservative in view of the circumstances.

(See p. 67 for itemized estimate.)

The appropriation for the fiscal year 1919 was \$3,500,000, but it was necessary to supplement this amount to the extent of approximately \$625,000 from appropriations of the Navy Department on account of the maintenance of vessels and stations of the Lighthouse Service transferred to that Department as authorized by the act of August 29, 1916 (39 Stat., 604). These vessels and stations were retransferred to the Lighthouse Service on July 1, 1919, and Navy Department funds will not be available for obligations incurred thereafter. The amount requested for 1921 is only about \$175,000 more than the amount available and expended in 1919, but this is necessary because of continued high costs, and the fact that insufficient funds the past few years has prevented the lighthouse property being maintained at a proper standard. There have been especially large increases, still continuing, in the expense of vessel repairs and cost of subsistence. Conservative estimates by superintendents of lighthouses for the necessary work in their districts for the fiscal year 1921, exclusive of expenses under control of the Bureau in Washington, aggregate nearly \$4,500,000.

The foregoing estimate of appropriation for "General expenses, Lighthouse Service" provides for a change in language from "laborers attending post lights" to "persons attending other lights." The proposed expression more appropriately and accurately covers the conditions intended to be provided for and is recommended as an improvement in the language of the appropriation act.

The act of August 28, 1916 (39 Stat., 538), provided for medical relief without charge for light keepers and assistant light keepers of the Lighthouse Service, at hospitals and stations of the Public Health Service under the rules and regulations governing the care of seamen of the merchant marine. The hospitals and stations of the Public Health Service are for the most part located at the principal ports, and while convenient for the use of seamen are inaccessible for a large number of lighthouse keepers who are stationed at remote and isolated points. Many keepers are, therefore, unable to avail themselves of the benefits of the legislation heretofore enacted. It is accordingly recommended that the Public Health Service be authorized to provide medical relief for light keepers and assistant light keepers without charge at other than hospitals and stations of the Public Health Service. The Secretary of the Treasury in letter of May 28, 1919, to the Secretary of Commerce concurred in the recommendation for such legislation.

Authority is also requested to cover the establishment and maintenance of post-lantern lights and other aids to navigation on the Yukon River and its tributaries, Alaska. The waters of the Yukon delta are already being marked, but congressional authority is required for the Lighthouse Service to extend its jurisdiction to the nontidal waters of these rivers. Navigation of the Yukon River is increasing each year, and as it is navigable for a long distance a great many lights and daymarks are required to safeguard the shipping that passes over it.

The act of June 20, 1918, which has now been in operation one year, providing for voluntary retirement at the age of 65 after 30 years service, and compulsory retirement at the age of 70, for certain classes of employees of the Lighthouse Service has proved beneficial both to the men eligible to retirement and to the Service in replacing such men with younger and more capable employees. Still greater efficiency, however, will result, and hardship to deserving employees will be avoided, if the same benefits are extended to persons who become disabled from efficiently performing their duties by reason of disability incident to their work, such disability being distinct from that caused by injury received in the line of duty, for which compensation is now provided by law. The legislation proposed herein restricts the benefit to the same classes of employees as specified in the act of June 20, 1918.

Light stations are for the most part situated at remote, isolated points where, in case of severe storm, tidal wave, fire, or other calamity, it is difficult or impossible to obtain assistance for the saving of property.

The light keepers in such emergencies, faithful to their duties and to the call of humanity, invariably have devoted themselves to the maintenance of the lights, the saving of public property, or to the protection or rescue of human life. As a result their own property has sometimes been destroyed or seriously damaged. This may represent the accumulations of a lifetime and a serious loss. The furnishings and equipment of light stations provided by the Government are designed only for actual necessities for the performance of a keeper's duties, and keepers must necessarily have personal property at the station. Similar conditions exist with reference to men on lighthouse vessels, though the personal property in such cases is generally confined to personal apparel.

The number of such cases has not been great and the enactment of the proposed legislation would not involve the Government in any great expenditure, but to the individuals concerned it is a matter of great importance; and when a case does arise, it carries a strong appeal, as it is not infrequently accompanied by some striking act of heroism. Congress has in the past occasionally passed special legislation reimbursing employees of the Lighthouse Service for their personal property lost or destroyed, but the process of securing such legislation is slow and in the majority of cases has failed, and the present lack of system consequently results in very unequal justice. Section 4 of the act of June 17, 1910 (36 Stat., 537), conferred upon the Commissioner of Lighthouses the authority to adjust, determine, etc., claims for damages, not exceeding \$500, arising out of collisions for which lighthouse vessels are responsible. This provision has worked satisfactorily, enabling the Government to settle with claimants with reasonable promptness and relieving Congress of the annoyance of many petty claims; and the expenditure of money involved has been very small. Similar legislation to cover claims for losses of private property by lighthouse employees, will, it is believed, be equally beneficial, and the conditions and limitations proposed are practically the same. Congress has already provided by law for reimbursement for losses sustained by men in the military service (Mar. 3, 1885; 23 Stat., 350), and in the naval service (Mar. 2, 1895; 28 Stat., 962).

Salaries, keepers of lighthouses.—For salaries of not exceeding 1,800 lighthouse and fog-signal keepers and persons attending other lights, exclusive of post lights, \$1,330,000.

NOTE.—The foregoing estimate calls for an increase of \$30,000 over the appropriation of \$1,300,000 made for this purpose for the fiscal year 1920 and is arrived at as follows:

1,500 keepers and assistant keepers at average pay of \$840.....	\$1,260,000
Persons attending other lights.....	92,367
	<hr/> 1,352,367

(See p. 67 for itemized estimate.)

Salaries, lighthouse vessels.—For salaries and wages of officers and crews of light vessels and lighthouse tenders, including temporary employment when necessary, \$2,100,000.

NOTE.—The amount estimated for is \$700,000 in excess of the appropriation for the fiscal year 1920, and is caused by the necessity of meeting the pay scales established by the U. S. Shipping Board for vessels of the merchant marine; otherwise it would be impossible to man the vessels of the Lighthouse Service.

Authorized base pay, August, 1919.....	\$1,920,744
Further increase necessary to meet Shipping Board scale for officers, 489 officers at average of \$300.....	146,700
Further increases for crews.....	32,556
	<hr/> 2,100,000

(See p. 67 for itemized estimate.)

Salaries, Lighthouse Service.—For salaries of 17 lighthouse superintendents, and of clerks and other authorized permanent employees in the district offices and depots of the Lighthouse Service, exclusive of those regularly employed in the office of the Bureau of Lighthouses, District of Columbia, \$490,000. Hereafter the annual salaries of superintendents of lighthouses, excepting the superintendent of the third lighthouse district, whose salary shall be \$4,500, shall not exceed an average of \$4,000.

NOTE.—An increase of \$110,000 over the appropriation for the fiscal year 1920 is submitted, consisting of the following:

Increase in the compensation of superintendents of lighthouses, authorization requested, 16 superintendents, at \$1,000 each and 1 at \$900.....	\$16,900
Additional employees (2 clerks, 1 assistant superintendent, 2 watchmen, and 1 assistant depot keeper).....	10,000
Proposed increases in the pay of district employees, in order to meet the general advance in compensation, 288 persons, at an average of \$300 each.....	86,400
	<hr/> 113,300

The item of \$10,000 is occasioned by the general growth of the service in order that work of the districts may be dispatched promptly.

(See p. 67 for itemized estimate.)

Retired pay, Lighthouse Service.—For retired pay of officers and employees, Lighthouse Service, \$85,000.

NOTE.—The act of June 20, 1918, provides, "That hereafter all officers and employees engaged in the field service or on vessels of the Lighthouse Service, except persons continuously employed in district offices or shops, who shall have reached the age of sixty-five years, after having been thirty years in the active service of the Government, may at their option be retired from further performance of duty; and all such officers and employees who shall have reached the age of seventy years shall be compulsorily retired from further performance of duty: *Provided*, That the annual compensation of persons so retired shall be a sum equal to one-fortieth of the average annual pay received for the last five years of service for each year of active service in the Lighthouse Service or in a department or branch of the Government having a retirement system, not to exceed in any case thirty-fortieths of such average annual pay received: *Provided further*, That such retirement pay shall not include any amount on account of subsistence or other allowance."

The amount required under this appropriation will necessarily increase gradually for a few years, as the number of persons annually becoming eligible to the benefit is greater than the number of retired employees who deace. The appropriation for 1919 was \$30,000, for 1920, \$45,000, and \$85,000 is estimated for 1921. Eventually, however, the amount required will become practically stationary.

DETAILED ESTIMATES FOR SPECIAL WORKS, 1921.

GROUP No. 1.

Works urgently necessary for the safety or immediate needs of navigation and for the preservation of existing structures or equipment, for the full utilization of other public improvements, or for the efficient equipment of the Lighthouse Service.

No. 1. *Lighthouse vessels, general service.*—Constructing or purchasing and equipping lighthouse tenders and light vessels for the Lighthouse Service, \$5,000,000.

NOTE.—Careful estimates and examinations as to the condition and further serviceability of vessels of the Lighthouse Service, show that it is very necessary to take prompt measures for replacing the older and wornout vessels of the Service. Immediate provision should be made for 17 vessels covered by this item in addition to the 3 vessels provided under the two following items in these estimates. This is considered indispensable, not only to the efficient operation of the Lighthouse Service in the protection of shipping, but for the reasonable safeguarding of the lives of those employed on vessels of this Service. The extent of the work required at this time is due to lack of sufficient appropriations for a number of years back, to keep up a proper rebuilding program, and to war conditions.

In view of the time required to design, contract for, build, and complete vessels, the whole of this plan should be provided for at the earliest practicable date. A full statement of this important need is made on pages 8 to 13 of this report.

3 tenders at \$400,000 each.....	\$1,200,000
1 tender for rivers.....	100,000
10 light vessels at \$335,000 each.....	3,350,000
3 light vessels at \$160,000 each.....	480,000
Total.....	5,130,000

No. 2. *Lighthouse tenders and light vessels.*—Constructing or purchasing and equipping lighthouse tenders and light vessels to replace vessels worn out in service in the third, fifth, and eighth lighthouse districts, or for use in the Lighthouse Service generally, \$760,000.

NOTE.—This vessel construction was authorized in the act of June 20, 1918 (40 Stat., 607), but no appropriation has been made therefor. This authorization was to provide vessels covered by several earlier estimates; under present conditions it is believed the amount will probably build two vessels. It is urgently necessary to replace at the earliest practicable time the tender *Gardenia* in the third district, and the tender *Jessamine* in the fifth district. The former has been condemned and put out of commission; the latter is a side-wheel tender, 38 years old, which can not much longer be kept in commission. A full statement of the urgent necessity for replacement of vessels in the Lighthouse Service is given on pages 8 to 13 of this report, including these two vessels, which are in addition to the vessels covered by the preceding item.

1 tenders at \$400,000 each (or 1 tender and 1 light vessel, if funds not sufficient).....	\$800,000
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No. 3. *Diamond Shoal (N. C.) Light Vessel.*—Constructing and equipping a light-vessel for station off Diamond Shoal, N. C., \$450,000.

NOTE.—Diamond Shoal Light Vessel No. 71 was sunk on this station by an enemy submarine on August 6, 1918, and it is very important from a maritime point of view that a properly equipped light vessel be constructed as soon as practicable to replace the vessel formerly on station. Diamond Shoal off Cape Hatteras is one of the most important and most exposed light vessel stations on the coast of the United States or in the world.

This vessel is included in the statement on pages 8 to 13 of this report, on the urgent necessity for replacement of vessels in the Lighthouse Service, and is in addition to the vessels in the two preceding items.

No. 4. *Hawaiian Islands lighthouse depot.*—Constructing and equipping a lighthouse depot at Honolulu, Hawaii, \$120,000.

NOTE.—The act of August 28, 1916 (39 Stat., 538), authorized \$90,000 for this work, but no appropriation was made therefor. The greatest need in this district is an adequate lighthouse depot. At present the depot is in a temporary rented building, costing \$100 per month, subject to vacating on short notice, to which the Service was recently compelled to move from the location on Channel wharf. This building is about one-third of a mile from the lighthouse wharf, which will result in considerable cartage expense. Moreover, the present location and building are not suitable for a lighthouse depot. The Lighthouse Service now has the necessary sites for its proposed depot in the nineteenth district, consisting of water front with small wharf in Honolulu and 1½ acres on Sand Island, across the harbor, which is to be utilized for a buoy depot.

It is proposed to build the present wharf out to the 140-foot slip line and extend it to a total length of 250 feet, making a total area of about 18,125 square feet, 8,000 of which will be new reinforced-concrete wharf on piles. General storehouse, machine and repair shop and oil house to be located on this wharf. On Sand Island site it is intended to erect a wharf of 30 by 100 feet on harbor line, build a continuation to wharf in the form of a concrete floor on the ground, and erect a 50 by 100 foot buoy shed. A depot keeper's dwelling to be erected as second story to storehouse. Detailed estimate:

Improvement and enlargement of former Naval Wharf, Honolulu—

Excavation and fill, 1,000 cubic yards, at \$1.50 per cubic yard.....	\$1,500
Retaining wall, reinforced concrete (14 by 4 feet), 155 linear feet, at \$6 per linear foot.....	930
Sea wall, reinforced concrete (24 by 8 feet), 275 linear feet, at \$18 per linear foot.....	4,950
Water and waste pipe (furnish, lay, and cover), 600 linear feet, at \$1.87 per linear foot.....	1,120
Improvement old wharf, grading and concrete paving, 4,500 square feet, at \$0.60 per square foot..	2,700
New reinforced concrete wharf, on piles, 8,000 square feet, at \$3.60 per square foot.....	28,800
Buoy wharf, Sand Island, reinforced concrete (30 by 100 feet), 3,000 square feet, at \$3.60 per square foot.....	10,800
General storehouse, reinforced concrete, 75,000 cubic feet, at \$0.43 per cubic foot.....	32,250
Machine and blacksmith shop, reinforced concrete, 20,000 cubic feet, at \$0.43 per cubic foot.....	8,600
Oil house, 7,500 cubic feet, at \$0.24 per cubic foot.....	1,800
Buoy repair and carpenter shop sheds, 2,500 square feet, at \$1.56 per square foot.....	3,900
Buoy shed, on concrete-paved floor, Sand Island (50 by 100 feet), 5,000 square feet, at \$2.16 per square foot.....	10,800
Equipment, general depot and buoy shed, Sand Island.....	1,000
Equipment, machine, carpenter, and blacksmith shop, lot.....	5,000
Keeper's dwelling, Sand Island, 12,500 cubic feet, at \$0.36 per cubic foot.....	4,500
Improvement of grounds, Sand Island.....	1,350
Total.....	120,000

No. 5. *Depot for fifth lighthouse district.*—Enlarging and improving the lighthouse depot at Portsmouth, Va., in the fifth lighthouse district, or establishing a new depot, \$350,000.

NOTE.—The act of June 20, 1918 (40 Stat., 607), authorized this work, but no appropriation was made therefor. The present lighthouse depot at Portsmouth, Va., is entirely inadequate to the needs of the fifth district, both in area and in water front. This depot is the principal supply station for the lighthouse work of Chesapeake Bay and the coast from Maryland to North Carolina, with the sounds and rivers. The increasing maritime and naval importance of the vicinity of Norfolk makes it urgent that a suitable depot be established promptly. It is the principal depot of one of the largest lighthouse districts, and is the headquarters for five tenders and two light vessels during the greater part of the year. The aggregate length of these vessels is over 1,000 feet; the total wharf frontage is only 240 feet, except 200 feet in a narrow slip available for small light-draft vessels only. The operation of tenders is much hampered by this limited frontage, the delay caused by waiting to discharge or receive cargo being estimated to cost the Lighthouse Service not less than \$25,000 a year. The very small area available for buoy storage necessitates much otherwise unnecessary handling of heavy buoys and appendages at large cost of time and money. The available wharf frontage of this depot should be doubled, and the area increased by several acres. This may be done by purchase of a new and larger site, or by purchase of adjacent property. The present buildings are mainly antiquated wooden structures. They constitute a fire menace and should be replaced by modern fireproof buildings. Detailed estimate:

Site, 500 feet water front, at \$250 per front foot.....	\$125,000
Wharf, at \$2 per square foot (50 by 700 feet).....	70,000
Track, at \$2.50 per linear foot (2,000 linear feet).....	5,000
Concrete bulkhead, at \$20 per cubic yard (1,820 cubic yards).....	36,400
Filling and grading, at \$3 per cubic yard (7,500 cubic yards).....	22,500
Concrete paving, at \$0.35 per square foot (90,000 square feet).....	31,500
Water mains in place, at \$2.50 per linear foot (1,000 linear feet).....	2,500
Electric lighting, power, wiring, and conduits.....	2,000
Chemical fire engines, at \$1,050 each (2).....	2,100
Traveling crane (1).....	6,000
Buoy skids and chain platform, at \$1.25 per square foot (50 by 160 feet).....	10,000
Miscellaneous equipment.....	8,000
Storehouse, at \$0.25 per cubic foot (100,000 cubic feet).....	25,000
Machine, blacksmith, and carpenter shops, at \$0.25 per cubic foot (60,000 cubic feet).....	15,000
Coal shed (80,000 cubic feet), at \$0.15 per cubic foot.....	12,000
Acetylene generating and compressing plant.....	5,000
Total.....	378,000

No. 6. *Virgin Islands, West Indies, aids to navigation.*—Establishing and improving aids to navigation in the Virgin Islands of the United States, and adjacent waters, West Indies, \$50,000.

NOTE.—The act of June 20, 1918 (40 Stat., 608), authorized this work, but no appropriation was made therefor. By Executive order of July 20, 1917, the lighthouse service in the Virgin Islands, West Indies, acquired by the United States by treaty from Denmark, was transferred to and placed under the jurisdiction of the United States Lighthouse Service. The aids to navigation in these islands are not extensive and will require additions and improvements to make the waters safe and to provide for increasing commerce. It is proposed to provide four unwatched gas lights, five new buoys, as well as additional aids as may be necessary after further study and developments, and to place existing lighthouse property in a good condition of repair. The Governor of the Virgin Islands, on July 15, 1919, wrote the Secretary of Commerce urging the importance of improvement of aids to navigation in the Virgin Islands. Detailed estimate:

4 unwatched lights, tower 25 feet high, at \$5,000 each.....	\$20,000
5 buoys with moorings, at \$1,000 each.....	5,000
Relief and spare equipment for lights and buoys.....	5,000
Repairs to existing property.....	10,000
Additional aids to navigation, as necessary.....	10,000
Total.....	50,000

No. 7. *Potomac River, Md., aids to navigation.*—Improving the aids to navigation and establishing new aids on the Potomac River, Md., \$95,000.

NOTE.—The act of June 27, 1918 (40 Stat., 608), authorized this work, but no appropriation was made therefor. The Potomac River is the poorest lighted and marked of the important navigable rivers of the United States, a condition which should not be allowed to continue, because of its relation to the National Capital and many Government activities, and its increased navigational importance. There are urgent requests from steamship companies for improvements in the lighting and marking of the Potomac River.



No. 10. *Depot for seventh lighthouse district.*—Purchasing site for and constructing and equipping a lighthouse depot for the seventh lighthouse district, \$250,000.

NOTE.—The Lighthouse Service storehouse, wooden smithy, and wharf are on property belonging to the Treasury Department, which is situated in the midst of the United States naval station. The wooden storehouse and wharf, which are highly inflammable, are located between the Navy coal sheds and piers A and B, one of each on each side and are, therefore, in an unusually dirty location. The coal dust is practically always in motion, and when the coal conveyors are in operation it blows about in clouds. It finds its way into the depot keeper's quarters and into the storehouse, where thousands of dollars' worth of property is stored, which it is impossible to keep clean. These coal sheds have been erected since the storehouse was built. Furthermore, there are frequently several Navy torpedo-boat destroyers lying alongside at the Navy piers on each side of the depot wharf, which, in addition to causing a great deal of dirt, are a menace to the lighthouse tenders on account of collision. A new site and wharf are now urgently needed for the efficient and economical work of the district. Detailed estimate:

Site, waterfront property, about 100,000 square feet, at \$1.25 per square foot.....	\$125,000
Wharf, at \$2.15 per square foot (30 by 400 feet).....	25,800
Bulkheading, at \$30 per linear foot (400 by 27 by 1 foot).....	12,000
Service building, at 44 cents per cubic foot (70,000 cubic feet).....	30,800
Keeper's dwelling, at 37 cents per cubic foot (24,000 cubic feet).....	8,880
Storehouse, at 18 cents per cubic foot (144,000 cubic feet).....	25,920
Oilhouse, at 28 cents per cubic foot (8,000 cubic feet).....	2,240
Machine shop, at 19 cents per cubic foot (12,000 cubic feet).....	2,280
Carpenter's shop, at 19 cents per cubic foot (12,000 cubic feet).....	2,280
Blacksmith shop, at 19 cents per cubic foot (12,000 cubic feet).....	2,280
Track on wharf, at \$1.80 per linear foot (2,400 linear feet).....	4,320
Buoy skids and chain platform, at \$1.50 per square foot (25 by 40 feet).....	1,500
Boundary fence, at \$3.50 per linear foot (680 linear feet).....	2,380
Water pipe (excavating, furnishing, laying, and covering), at \$1.55 per linear foot (280 linear feet).....	434
Shop equipment.....	3,886
Total.....	250,000

No. 11. *Conneaut Harbor, Ohio, aids to navigation.*—Completing the light and fog signal at Conneaut Harbor, Ohio, \$19,600.

NOTE.—The act of July 1, 1916 (39 Stat., 317), appropriated \$63,500 for a light and fog signal and improving the existing aids in Conneaut Harbor. Owing to the increased cost of labor and material caused by war conditions it is impracticable to complete the station within the amount of the appropriation. Additional funds are required to complete the superstructure of the station, including interior finishing, and to purchase and install the requisite illuminating and fog signal apparatus. Conneaut is an important ore and railroad port, 3,000 vessels a year entering and departing, with total tonnage of approximately 9,000,000. There is an all-year ferry trade out of this port across the lake to Port Stanley, Ontario, for which the present fogbell is an inadequate signal. This project is considered urgently necessary for the immediate needs of the Lighthouse Service, and to complete it \$19,600 will be required. Detailed estimate:

Plastering.....	\$750
Tile flooring and base.....	1,500
Carpentry.....	1,125
Plumbing and drainage.....	575
Painting.....	950
Illuminating apparatus.....	2,200
Fog-signal apparatus.....	12,500
Total.....	19,600

No. 12. *Ludington, Mich., aids to navigation.*—Improving aids to navigation and establishing new aids at Ludington, Mich., \$75,000.

NOTE.—The present location of the fog-signal station on the end of south pier is 1,500 feet inside of entrance to outer harbor. At present the actual entrance between the breakwaters must be found by feeling around in the fog. This subjects vessels to danger of striking the breakwater. The commerce of Ludington, which includes important car-ferry lines across Lake Michigan, is as important as any other port on the east shore of Lake Michigan, and as this port is most inadequately lighted now this improvement is considered well warranted. It is proposed to establish a main light on the outer end of the north breakwater, with fog-signal apparatus, consisting of electrically-driven air compressor and compressed-air fog signal with oil-engine reserve drive, and to discontinue the present steam fog signal in old wooden structure. Quarters for keepers are to be erected adjacent to the light, as it is unsafe to cross the harbor during the winter and when the ice is constantly broken up by car ferries. The present dangerous condition should be corrected as early as practicable. Detailed estimate:

North Breakwater (main light):	
Reinforced-concrete foundation, approximately 24 by 24 feet by 20 inches high, 427 cubic yards, at \$30 per cubic yard.....	\$12,810
Steel tower, concrete lined, base 15 feet square, top 10 feet square, 40 feet high, 6,480 cubic feet, at \$1.25 per cubic foot.....	8,100
Cast-iron lantern house, 4th order.....	1,900
Fog-signal house, brick and tile, 18 by 33 by 14 feet, 8,500 cubic feet, at 60 cents per cubic foot..	5,100
Foundation for fog-signal house, 60 cubic yards concrete, at \$12 per cubic yard.....	720
Fog-signal apparatus.....	17,770
Illuminating apparatus—	
Fourth-order lens with electric light.....	2,500
Total for north breakwater.....	48,900
South pier—	
Concrete foundation.....	600
31-foot steel tower.....	400
Total for south pier.....	1,000

North Breakwater (main light)—Continued.

North pier—

Concrete foundation, 30 cubic yards, at \$20 per cubic yard.....	\$600
31-foot skeleton steel tower.....	1,200
300-millimeter lens lantern and electric light.....	300
1,000-foot electric transmission pole line.....	500
Total for north pier.....	2,600

Keepers' dwelling—

New lot.....	500
Three-family house, tile and concrete, 45 by 40 by 30 feet, 54,000 feet, at 36 cents per cubic foot.....	19,500
Outbuildings.....	1,000
Sidewalks, grading, fences, shore, protection, etc.....	1,500
Total for keeper's dwelling.....	22,500

Grand total.....	75,000
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No. 13. *Tampa Bay, Fla., aids to navigation.*—Establishing and improving aids to navigation in Tampa Bay, Fla., \$17,500.

NOTE.—Tampa is an important seaport with a large and growing commerce by sea. Owing to shallow water in Tampa Bay, deep-draft vessels can reach the city from the Gulf only by means of several comparatively narrow dredged cuts. Provision has already been made for lighting all of the important cuts excepting Cut D, for which lights should be provided as soon as practicable, as large vessels must pass through this cut in order to reach Port Tampa. Detailed estimate:

Tower, structural steel, at 19 cents per pound (32,100 pounds), and cast iron, at 8.8 cents per pound (41,860 pounds).....	\$9,800
Reinforced-concrete piling, in place, at \$15.20 per cubic foot (125 cubic feet).....	1,900
Illuminating apparatus (including installation).....	5,800
Total.....	17,500

No. 14. *Delaware Bay Entrance, aids to navigation.*—Improving the aids to navigation at the entrance to Delaware Bay, \$148,500.

NOTE.—In consequence of the continued erosion of the shore line in the vicinity of Cape Henlopen Light, Del., the early destruction of that light unless removed is anticipated, measures taken for the preservation of the shore line having proved unavailing. Every purpose now served by Cape Henlopen Light would be better served by the rebuilding of Harbor of Refuge Light to a height of about 140 feet, as here proposed. The establishment of large gas buoys is also required, one midway between, and in the line connecting Five Fathom Bank Light Vessel and Overfalls Light Vessel, one at the extreme lower and outer end of Hen and Chickens Shoal, and one in approximately the present position of Fifteen Foot Shoal Buoy. With the improvements recommended herein, including a red sector in the new Harbor of Refuge Light to cover Brown Shoal, the ultimate fate of Cape Henlopen Light will have no bearing on the practical needs of navigation in this vicinity. Detailed estimate:

Rebuilding Harbor of Refuge tower, reinforced concrete, including living quarters, at \$2.70 per cubic foot (45,000 cubic feet).....	\$121,500
4 gas and bell buoys, at \$4,000 each.....	16,000
2 extra 375-millimeter lanterns, at \$1,000 each.....	2,000
2 extra gas tanks, at \$600 each.....	1,200
Sinkers and moorings for buoys, 4 at \$375 each.....	1,500
Illuminating apparatus in tower.....	3,500
Fog-signal apparatus.....	1,300
Boats.....	1,500
Total.....	148,500

No. 15. *Newport, R. I., lighthouse depot.*—Purchasing site and building wharf and storehouse for new lighthouse depot in Narragansett Bay, same to be located at Newport, R. I., or vicinity, \$82,300.

NOTE.—The present depot is located on the breakwater at Newport Harbor, which location is very unsatisfactory and inconvenient, as the water at the dock is too shoal for the larger tenders, and there are no facilities for tenders getting water, or having provisions, ice, etc., delivered, which necessitates the tenders going to Newport for provisions, etc., causing much waste of working hours. The Navy Department is building along the breakwater continuously and the present plans of the Navy bring them down to the lighthouse depot. The present dock is in very bad condition, due to age, decay, and worming of piles, and at present is unsafe for further use. Improvement of the depot on the existing site is not considered economical, owing to lack of space and other conditions. Detailed estimate:

Site for new depot.....	\$40,000
Piling, 300 piles, at \$80 each.....	24,000
Concrete dock, 350 cubic yards, at \$30 per cubic yard.....	10,500
20,000 feet timber, at \$165 per 1,000 board feet.....	3,300
Storehouse, 15,000 cubic feet, at 30 cents per cubic foot.....	4,500
Total.....	82,300

No. 16. *California and Nevada aids to navigation.*—Establishing aids to navigation, California and Nevada, \$44,750.

NOTE.—Numerous petitions have been received for lighting the channel between Point San Mateo and the mouth of Alviso Slough, San Francisco Bay. This waterway is the natural outlet for nearly all the produce of the extensive Santa Clara Valley, and the annual traffic has been greatly increased on account of the greatly increased demand for this produce. The present channel is narrow and winding and there are no aids to assist mariners in keeping off the shoals at night. Accidents and strandings are of frequent occurrence. Much of the traffic must be carried on at night to take advantage of the tides. Additional lights

are urgently needed and should be established at once. Gas buoys should also be provided at Fort Rose and Point Buchan, on the coast of California; these are necessary for the protection of coastwise shipping. There is an urgent demand for a more suitable lighted buoy at Crescent City, Calif.; during the past year one vessel was lost and another damaged at this entrance. There is a heavy traffic in the north channel of Suisun Bay, and two additional lights and echo boards are necessary. The act of August 28, 1916 (39 Stat., 538), authorized aids to navigation on Lake Tahoe, Calif. and Nev., but no appropriation was made therefor, and funds have not been available to properly light the lake, on which are now many power boats. Lake Tahoe has an area of approximately 200 square miles, is 21 miles long, has a mail route 70 miles long, and a great many passengers are carried there annually on numerous steamers and launches. Detailed estimate:

San Francisco Bay, Alviso Channel:	
Acetylene-lighted beacons, 3 at \$1,500 each.....	\$4,500
Acetylene-gas buoy, type "L".....	4,000
Coast of California, gas and whistle buoys at Point Buchan and Fort Rose, 2 at \$5,000 each.....	10,000
Gas and bell buoy at Crescent City.....	4,500
Spare buoys, one gas and bell, type "L".....	4,000
3 gas buoys, type "S" at \$1,500 each.....	4,500
Suisun Bay, 2 lights and echo boards, at \$1,250 each.....	2,500
Lake Tahoe, 4 gas buoys, type "S," at \$1,500 each.....	6,000
Lamp houses and lanterns, 3 at \$1,250 each.....	3,750
Daymarks, single pile, 5 at \$100 each.....	500
Transportation and subsistence.....	500
Total.....	44,750

No. 17. *Depot keepers' dwellings.*—Construction of two dwellings at the Goat Island Lighthouse Depot, Calif., \$18,000.

NOTE.—The present quarters at the Goat Island Lighthouse Depot, consisting of two old frame cottages located at the water's edge, are wholly inadequate to accommodate the depot force. There are no quarters available for the assistant depot keeper, mechanic, and skilled laborer, all of whom are required to make long journeys to and from San Francisco each day. On account of the position of Goat Island in the middle of San Francisco Bay, with no ferry accommodations except such as can be obtained by means of the Naval Training Station boats, it is essential that all employees at the depot should be housed on the lighthouse reservation, as they are unable to properly carry on their work under present conditions. Orders have recently been issued by the Navy Department to remove the Naval Training Station from Goat Island on account of inclement weather conditions, and it is probable that the present launch service to the island will be very seriously reduced in the near future with great detriment to the Lighthouse Service. Two dwellings are urgently required to be built on the high ground adjacent to the depot for the accommodation of the keeper and the mechanic in charge of the depot shops. Detailed estimate:

Two dwellings for keepers, at \$0.275 per cubic foot (65,455 cubic feet)..... \$18,000

No. 18. *Cape Spencer (Alaska) Light Station.*—Establishing a light and fog-signal station at or near Cape Spencer, Alaska, \$150,000.

NOTE.—Cape Spencer is at the entrance to Cross Sound and Icy Strait, through which pass all vessels running from Puget Sound ports to Prince William Sound, Seward, Cook Inlet, and Kodiak, excepting only occasional freighters proceeding by outside route. Traffic by way of Cape Spencer is materially increasing owing to construction work on the Government railroad and the consequent development of western and southwestern Alaska. A small unwatched light is now maintained on the cape, but a more powerful watched light and a fog signal of the first class should be provided. A landfall must be made in this vicinity by all vessels returning from the westward, and as the entrance to Cross Sound is difficult to make, especially in thick weather, it is important they be given all the assistance possible. Maritime interests are urging the establishment of this aid. Detailed estimate:

Construction plant, including wharf and storehouse.....	\$14,400
Transportation of men and materials.....	13,000
Tower, including fog signal and living quarters, at \$1.12 per cubic foot (65,000 cubic feet).....	72,800
Lantern, watch room, and other metal work, at 22 cents per pound (83,500 pounds).....	18,400
Boat house, at 25 cents per cubic foot (9,600 cubic feet).....	2,400
Hoist houses, hoists, and derrick.....	8,500
Illuminating apparatus.....	11,000
Fog-signal apparatus.....	9,500
Total.....	150,000

No. 19. *Galveston Jetty (Tex.) Light Station.*—Improving Galveston Jetty Light Station, Tex., \$6,500.

NOTE.—The original appropriations, June 11, 1896 (29 Stat., 417), and May 27, 1908 (35 Stat., 332) for this station are insufficient for the purchase and installation of a sufficiently powerful fog signal. The commerce of the port of Galveston has been steadily increasing, consisting especially of shipments of cotton, grain, flour, lumber, steel, and canned goods. For the first five months of the calendar year 1919 the value of foreign exports from this port, exclusive of shipments in bond and the coastwise trade, was \$131,997,109, and imports, \$7,137,929. Four million four hundred and ninety-nine thousand eight hundred and sixty-nine tons of freight were handled at this port in the year 1918, and an adequate fog signal is required to enable vessels to enter Galveston entrance during foggy weather. A fog signal has been urgently requested by the Galveston Commercial Association. It is recommended that a compressed-air fog signal be installed as soon as funds permit. Detailed estimate:

Fog-signal apparatus, in duplicate.....	\$5,000
Piping, valves, shafts, foundations, etc.....	800
Installation.....	600
Incidentals.....	100
Total.....	6,500

No. 20. *Additional buoys, fifth lighthouse district.*—Establishing additional buoys in Chesapeake Bay and York River, Va., for use of Atlantic Fleet, \$44,600.

NOTE.—There were established during the war a considerable number of additional buoys, including many gas buoys, for the use of the Atlantic Fleet in marking approaches to bases and drill grounds in the lower Chesapeake Bay and York River. It was possible to establish and maintain these buoys during the war emergency only by using buoys normally and properly held in reserve for relief

purposes, the marking of wrecks, etc., and temporarily discontinuing certain gas buoys in other localities. The reestablishment and maintenance of these aids has been requested by the Navy Department. Detailed estimate:

10 type "L" gas and bell buoys, at \$3,481.70 each.....	\$34,817
1 main channel bell buoy.....	950
1 type "BW" 600-11 gas and whistling buoy.....	5,013
Chain, sinkers, and shackles.....	3,820
Total.....	44,600

No. 21. *Staten Island, N. Y., lighthouse depot.*—Improving and extending the wharves at the general lighthouse depot, Tompkinsville, Staten Island, N. Y., \$65,000.

NOTE.—The act of June 20, 1918 (40 Stat., 607), authorized the work of improving and extending the wharves at the general lighthouse depot, but no appropriation was made therefor. A portion of the wharves at the general lighthouse depot are in a poor condition and need repairs. The appropriation of \$60,000 made by the act of March 28, 1918 (40 Stat., 496), for repairing the wharves, has enabled the Lighthouse Service to accomplish the retopping of the inner south wharf and the inner north wharf, but the increase in cost has made it impracticable to complete the entire repairs needed. Improvements to the south extension of the north wharf, the bulkhead wharf, and the north end of the bulkhead yet remain to be done and are urgently needed, as these sections are in poor condition and hardly serviceable. Temporary repairs to these wharves would be expensive and wasteful. The authorized amount is not sufficient to provide for the extension of the wharves originally proposed, and this may be deferred. The present wharf space is limited and the wharves should be extended. There are 21 vessels in the third district (7 tenders and 14 light vessels) which use the general depot wharves, besides a considerable use by vessels of the Navy Department and commercial ships. Detailed estimate:

14,000 square feet of new top, at \$2.15 per square foot.....	\$30,000
10,000 square feet of top renewed, at \$3.50 per square foot.....	35,000
Total.....	65,000

No. 22. *Detroit, Mich., lighthouse depot.*—For completing the improvements to the Detroit lighthouse depot, Mich., \$50,000.

NOTE.—The act of July 1, 1918 (40 Stat., 686), appropriated \$53,000 for improvements at the Detroit lighthouse depot, but, on account of the great advance in the cost of labor and materials, it is impracticable to complete the work estimated for within the amount appropriated. It is estimated that \$34,500 additional is required to complete this work. The only work thus far accomplished is the construction of the outer section of the wharf, which is now in progress, but beyond the completion of this piece of work, it will not be practicable to proceed further with the project without additional appropriation. Further improvements at the depot have since been found necessary which it is desirable and economical to have done as a part of the work already authorized. These consist of the construction of a retaining wall along Mount Elliott Avenue adjoining the lighthouse depot, and the purchase and installation of mechanical equipment in the proposed lamp shop. The latter will enable the Service to make repairs to illuminating and fog-signal apparatus and repairs to vessels during the closed season of navigation, at a considerable saving over the cost in commercial shops. Detailed estimate:

Wharf, 19,900 square feet, at \$3.30.....	\$65,670
Dredging, 3,400 cubic yards, at \$1.....	3,400
Mooring bullards, 9, at \$60.....	540
Steel track, 600 linear feet, at \$1.50.....	900
Water supply, electric works, etc.....	490
Lamp shop, 27,000 cubic feet, at \$50.....	13,500
Retaining wall, 500 linear feet, at \$10.....	5,000
Machinery and equipment.....	8,000
Contingencies.....	5,500
Total.....	103,000
Less appropriation made by act of July 1, 1918.....	53,000
Amount required.....	50,000

Total group No. 1, authorized by law \$1,423,000; not authorized \$6,566,500. Total \$7,989,500.

GROUP NO. 2.

Works considered essential for the needs of navigation and the equipment of the Lighthouse Service, and which it is recommended be undertaken as resources permit, are submitted with estimates of cost. (These items have been selected from a much larger number of recommendations submitted by the superintendents of the lighthouse districts and others.)

No. 23. *Point Pinos (Calif.) Light Station.*—Improving Point Pinos Light Station, Calif., \$40,000.

NOTE.—Traffic to the port of Monterey just inside of Point Pinos is steadily increasing, and the port is now one of the leading points for the shipment of crude oil on the coast. This port has the most important fishing industry on the coast of California, and several thousand large power fishing boats make their headquarters here. Numerous requests have been received from shipping interests and from fishermen's unions to establish a first-class fog signal at this point. The Union Oil Co. has lost one steamer at the entrance to the harbor, and, as there is an average of 800 hours of fog per annum, the protection asked for is urgently required. In addition to a fog-signal building a dwelling for two keepers is required. Detailed estimate:

Fog-signal building.....	\$5,015
Fog-signal apparatus.....	11,500
Dwelling for two keepers.....	17,985
Improvements to present station.....	5,500
Total.....	40,000

No. 24. *Woods Hole, Mass., lighthouse depot.*—Dredging off a point to give entrance to Little Harbor, Woods Hole Depot, Mass., \$15,000.

NOTE.—Owing to the excessive current at the outer shoal, the bar through which the channel was dredged in 1917 has again filled in, and it is believed that it is impracticable to maintain a channel through this bar owing to the excessive current. By cutting off the point referred to and following the natural course of the channel, it is believed that no difficulty from filling in will be experienced at this point in the future. This work to be done by contract, as it can be done more efficiently and economically by this method. Detailed estimate:

Dredging, 30,000 cubic yards, at \$0.50 per cubic yard..... \$15,000

No. 25. *Michigan Island (Wis.) Light Station.*—Establishing and improving aids to navigation at or near Michigan Island, Lake Superior, Wis., \$85,000.

NOTE.—The act approved May 27, 1908 (35 Stat., 332), appropriated \$2,000 to make a survey and estimate of cost and report upon the feasibility and need of establishing a light and fog signal upon Gull Island or the easterly end of Michigan Island, Apostle Group. As a result of this survey, the conclusion has been reached that the eastern end of Michigan Island is the better site. The act of June 17, 1910 (36 Stat., 536), authorized the construction of a light and fog-signal station at Michigan and Gull Islands at a cost not to exceed \$140,000, but no appropriation has been made therefor. A further study indicates that the best plan is to elevate the present light near the westerly end of Michigan Island, add a fog signal, and establish a nonattended acetylene light on Gull Island. This arrangement would serve as a better guide to vessels passing in either direction. The project now contemplated will not cost as much as the amount authorized. Detailed estimate:

Foundation, main light.....	\$3,000
Dwellings for three keepers.....	20,000
Tower complete (erection only).....	6,000
Minor light.....	9,495
Illuminating apparatus.....	10,000
Fog signal and hoisting apparatus.....	13,550
Fog-signal building, boathouse, and other buildings.....	13,455
Boats, tramway, walks, etc.....	9,500
Total.....	85,000

No. 26. *Kauhola Point (Hawaii) Light Station.*—Improving the light station at Kauhola Point, Hawaii, \$20,000.

NOTE.—Owing to the importance of this station, located near the northern point of the Island of Hawaii, steps have been taken to change the present lens-lantern light to a converted flashing fourth-order lens. To support this lantern and lens and to complete the improvement of this station, a new tower is necessary, a dwelling for the assistant keeper should also be provided. Detailed estimate:

Reinforced-concrete tower in place, 72 ft. high.....	\$15,750
Dwelling, frame.....	4,000
Improvement to grounds.....	250
Total.....	20,000

No. 27. *Santa Barbara (Calif.) Light Station.*—Improving Santa Barbara Light Station, Calif., \$40,000.

NOTE.—The station is old and the tower is too small to accommodate the revolving lens now installed in it. The tower stands one-eighth of a mile back from the point of the shore line and the light is partly obscured by trees on other properties. A new tower is required to be built farther out on the point. Coasting vessels bound north keep close inshore to avoid the prevailing northwesterly winds and sea, and a fog signal should be established here with quarters for two additional keepers. At present there are no fog signals between Point Hueneme and Point Conception, and there is a very heavy traffic through this part of the Santa Barbara Channel, and as several strandings have already occurred in the vicinity of the light station, there is urgent need for this improvement. A fog signal and a new light tower, together with suitable quarters for an additional keeper are required. Detailed estimate:

Tower, lantern, and fog-signal building.....	\$15,500
Fog-signal apparatus.....	11,500
Additional quarters.....	9,520
Improvements to present station.....	3,480
Total.....	40,000

No. 28. *Portage Lake, Mich., aids to navigation.*—Establishing a light and fog-signal station upon a new site and improving aids to navigation at Portage Lake Ship Canals, Mich., \$100,000.

NOTE.—The War Department intends to remove the breakwater, and it is therefore necessary to rebuild the light and fog signal on a new site. The new light and fog signal should be established on a pier of the outer entrance where it would be of the best service to vessels making the harbor. The construction of the station would require considerable time to complete, and this project should have consideration for that reason. The harbor pier on which the present pierhead light station and fog-signal house stand, as well as the timber superstructure under the fog-signal house, are rapidly deteriorating, and it is doubtful if these structures can be maintained much longer in a safe condition unless extensive repairs are made to their foundations, which would be unnecessary in the event of the establishment of the proposed new station. Detailed estimate:

Foundation and concrete base of tower.....	\$64,000
Superstructure.....	22,500
Fog signal and lighting equipment.....	13,500
Total.....	100,000

No. 29. *Ram Island (Me.) Light*.—Establishing a light on Ram Island, lower Kennebec River, \$5,400.

NOTE.—The need of this light has several times been expressed by petition. Ram Island is about 5½ miles below Bath, Me.; it is a low island in the middle of the river, with a string of half-tide ledges making off on the easterly side. There is a passage on either side, and at some stages of the tide a 5-knot current exists, from which several accidents have occurred. About 420,000 tons of freight and 175,000 passengers are transported past this island annually, not including the many pleasure craft and small boats which frequent the river. It is proposed to establish an acetylene light on or near the easterly side of Ram Island. Detailed estimate:

Light structure, including site.....	\$3,050
Illuminating apparatus and installation.....	1,950
Contingencies.....	400
Total.....	5,400

No. 30. *Cape Kumukahi (Hawaii) Light*.—Establishing a light at or near Cape Kumukahi, Hawaii, \$22,000.

NOTE.—Cape Kumukahi is the easternmost cape of Hawaii. There is at present no landfall light for vessels bound to Hilo from the Panama Canal or from the southeast. It is a difficult point to round when sailing from Hilo to the south point or vice versa. A light on this point would be a great improvement to the lighting of the islands. An acetylene light is recommended, with a focal-plane height of about 145 feet above the sea, which would be visible about 20 miles. Landing from seaward at the cape is impossible at most times, and the only practical method of supplying this station would be by railroad from Hilo to Kapoho and then by wagon road 3 miles to the cape, 1½ miles of which would have to be constructed over the rock. Detailed estimates:

Station site and right of way for road.....	\$500
Concrete foundation for tower.....	740
Superstructure, iron-pipe tower.....	9,000
Illuminating apparatus.....	4,640
Roadway, construction of.....	7,120
Total.....	22,000

No. 31. *Henderson Point (Me.) Light Station*.—Establishing a light and fog signal at or near Henderson Point, Piscataqua River, Portsmouth Harbor, Me., \$7,500.

NOTE.—The need of this aid has several times been expressed by petition. It is often very difficult to locate Henderson Point at night and in thick weather; the channel is narrow and there is a strong tide at this point, where the course changes. The commercial statistics for Portsmouth Harbor indicate about 5,600 vessels arriving and departing annually, transporting about 610,000 tons of freight. It is proposed to establish an acetylene light with fog bell. Detailed estimate:

Structure, including site.....	\$3,350
Illuminating and fog-signal apparatus.....	3,750
Contingencies.....	400
Total.....	7,500

No. 32. *Port Real (P. R., or East Point Vieques Island) Light Station*.—Establishing a light station at or near Port Real, P. R., or East Point Vieques Island, \$40,000.

NOTE.—The lighthouse at Port Ferro, on the south coast of Vieques, or Crab Island, is one of the primary seacoast lights of the Porto Rican system. The light tower and the keepers' dwelling attached to it are built on top of a rocky promontory undermined for some time by the sea, and the whole structure, already dangerously cracked, is in danger of collapsing. It is urgent to rebuild a lighthouse at or near this point, as this is an important aid to the navigation from St. Thomas to Cuba and other West Indian Islands and the Caribbean Sea. A light in this vicinity is necessary for navigation, and it is proposed to dismantle the present Port Ferro Light Station and to erect a new light station at Port Real, about 3 miles westward, where the aid will be more useful and on better ground than on its present location at Port Ferro, as Port Real is the most important and the best anchorage around Vieques Island. The present apparatus at Port Ferro is to be used for this new station. Detailed estimate:

Tower.....	\$15,000
Dwelling for 2 keepers.....	10,000
Metal work.....	8,000
Woodwork.....	2,000
Outbuildings and fence.....	1,000
Purchase of site.....	2,000
Grading and walks.....	1,000
Installation of illuminating apparatus.....	1,000
Total.....	40,000

No. 33. *Nine Mile Point (Mich.) Light Station*.—Establishing a light and fog-signal station at or near Nine Mile Point, Mich., \$50,000.

NOTE.—When Forty Mile Point Light Station was established it was placed on the site designated Forty Mile Point on the county-survey charts. Sailing masters expected the station to be placed at Nine Mile Point, near the entrance to the Straits of Mackinac, but which was not so called officially then. While Nine Mile Point is within the visibility of Spectacle Reef and Poe Reef Light Vessel lights, a fog signal would be of especially great service in thick and foggy weather and during seasons when forest fires prevail. No less than nine strandings occurred here between 1903 and 1909. In the event of establishing this station, Forty Mile Point could be made a minor light. Detailed estimate:

Tower and fog-signal building, including site.....	\$26,100
Illuminating apparatus.....	5,500
Fog-signal apparatus.....	2,000

Dwellings for three keepers.....	\$12,000
Outbuildings, boathouse, fences, etc.....	2,600
Boats and equipment.....	1,800
Total.....	50,000

No. 34. *Grays Harbor (Wash.) Light Station.*—Improving Grays Harbor Light Station, Wash., \$20,000.

NOTE.—The present steam fog-signal plant at this station is located in a frame building. Both the machinery and building are quite old and in poor condition. It is proposed to construct a new fireproof building and install an electrically operated siren as soon as funds permit. Detailed estimate:

Fog-signal building.....	\$9,690
Purchase and installation of apparatus.....	10,310
Total.....	20,000

No. 35. *Aids to navigation, Alaska.*—Establishing new aids to navigation and for improvements to existing aids in Alaska, \$75,000.

NOTE.—An appropriation of \$75,000 was made by the act of July 19, 1919, for aids to navigation in Alaska but a considerable part of this has already been obligated, and there is a demand from maritime interest, for the further establishment of new aids to facilitate and safeguard water transportation in Alaska, where navigation is unusually difficult and hazardous, as shown by the frequency of marine disasters occurring in these waters. A number of unwatched lights on shore or on reefs, and a number of lighted buoys are needed to mark the principal routes of navigation through inside passages. A few such lights are needed to mark headlands on the outside coast for the benefit of coasting traffic, and there are a number of requests for lights to mark the entrance to harbors where fish packing or other plants are located. The fishing industry in Alaska is now being greatly expanded and many new plants are being constructed in localities not heretofore visited by large steamers. This fact has given rise to a greatly increased demand for new aids. Detailed estimate:

2 gas buoys, at \$8,100 each.....	\$16,200
4 gas buoys, at \$5,100 each.....	20,400
3 lights on steel towers, at \$4,000 each.....	12,000
6 lights, at \$2,000 each.....	12,000
7 lights, at \$1,300 each.....	9,100
4 lights, at \$800 each.....	3,200
Miscellaneous minor aids.....	2,100
Total.....	75,000

No. 36. *Lake Champlain, N. Y.*—Establishing acetylene lights, building and equipping a gasoline tender, and rebuilding Juniper Island Light Station wharf to accommodate the tender on Lake Champlain, and other improvements to aids to navigation on Lake Champlain, \$150,000.

NOTE.—In the interest of efficiency and economy it is proposed to discontinue all oil lights on Lake Champlain except at stations where there is a fog bell, and establish acetylene lights in their places. The motor-driven tender will remain constantly on the lake to care for the operation and repair of the light stations. This change from oil to acetylene will result in considerable saving. It will permit better care and maintenance of the aids to navigation on Lake Champlain and relieve the tender *Daisy* from this work, thus enabling her to do more work in the vicinity of New York Bay, where her services are much needed. Detailed estimate:

8 large lights.....	\$25,000
21 small lights.....	55,000
Gasoline tender.....	25,000
Rebuilding wharf at Juniper Island Light Station, with storeroom, gas-tank house, and ways for taking tender out of water in winter.....	45,000
Total.....	150,000

No. 37. *Sag Harbor, N. Y.*—Establishing five acetylene lights in the channel leading into and in the vicinity of Sag Harbor, N. Y., and improving illuminating apparatus at Sag Harbor Breakwater and Cedar Island Light Stations, \$45,700.

NOTE.—This channel is crooked, narrow, and rocky, and a system of acetylene flashing lights is much needed. It is proposed to place the lights on steel towers having concrete and riprap foundations. Detailed estimate:

5 acetylene lights complete.....	\$30,600
Improving illuminating apparatus, Sag Harbor Breakwater Light.....	6,100
Improving illuminating apparatus, Cedar Island Light.....	9,000
Total.....	45,700

No. 38. *Repairs and improvements, light stations, Alaska.*—Repairs and improvements to existing aids to Alaska, \$77,000.

NOTE.—Owing to the increasing volume and importance of the commerce of Alaska, it is very desirable that important improvements be made in certain lights and fog signals, as urged by mariners. Also, it is necessary to replace some worn-out station equipment, and at some stations improvements are needed for the betterment of protection of the station. At Guard Island, an important station at the westerly end of Tongass Narrows, it is desired to replace the present unsatisfactory fog bell with an air diaphone and to construct a suitable permanent light and fog-signal building to replace present temporary wooden tower; also to erect another dwelling in order that two keepers may be assigned instead of one as at present, and thus provide for continuous night and day watches. At Point Retreat, an important station, there is

now only an unwatched acetylene light and no fog signal. All regular vessels plying between southeastern and southwestern Alaska pass this point, either by way of Favorite Channel or by way of Lynn Canal and Skagway. It is proposed to establish an air diaphone fog signal and assign keepers, a suitable permanent structure to be erected for the light and fog signal, and unused dwelling now at the station to be repaired and refurnished for the use of the keepers. At Scotch Cap it is proposed to install a flashing lens in place of present fixed lens, which will increase the power of the light and render it distinctive from other fixed lights. This is an important coast station located on Unimak Pass and is made by all vessels passing from the Pacific Ocean to Bering Sea. Shore protection is also needed at this station, as the dwellings are threatened by encroachment of the sea, and new machinery is needed to replace that worn out in service. At Tree Point Light Station present water supply is subject to interruption through freezing and is not considered healthful. It is proposed to lay a pipe line to a lake about 1 mile distant. Mariners have complained that the air siren fog signal at Cape Hinchinbrook Light Station is not effective, and it is desired to replace same with an air diaphone. This is a very important station situated at the entrance to Prince William Sound. Detailed estimate:

Guard Island Light Station—Install diaphone, construct light and fog-signal building, erect dwelling, etc.	\$30,500
Point Retreat Light—Install diaphone, construct light and fog-signal building, repair dwelling, etc.	31,000
Scotch Cap Light Station—Purchase new compressors and engines, install flashing lens in place of fixed lens, construct shore protection.	10,000
Tree Point Light Station—Construct pipe line from lake to station	2,000
Cape Hinchinbrook Light Station—Install diaphone in place of present siren	1,500
Contingencies, repairs, and improvements.	2,000
Total.	77,000

No. 39. Depot for second lighthouse district.—Completing the construction and equipment of a lighthouse depot for the second lighthouse district, \$123,645.

NOTE.—The act of July 1, 1918 (40 Stat., 607), appropriating \$85,000 for dredging two slips, building retaining walls to same, rebuilding wharf, building service building and oil house, etc., at Chelsea, Mass., was based upon estimates made in 1911. The great advance in cost of building materials and labor makes the appropriation inadequate for the purpose intended. The present lighthouse depot in the northern end of the second district is located on Lovells Island about 9 miles from Boston, and is on land belonging to the War Department and urgently required by them for war purposes. The transaction of the work in the northern end of second district is greatly handicapped and the duties of the tenders much increased by having the base of supplies located nearly an hour's steaming from Boston. The new depot at Chelsea should be properly equipped and the depot established there at the earliest practicable date. The work of construction to be done by contract, as it can be done more efficiently and economically by this method. Detailed estimate:

Dredging.	\$19,200
Retaining walls.	78,191
Wharf.	15,000
Filling and grading.	6,000
Service building, fireproof, 35 by 80 feet.	45,000
Keeper's dwelling, 25 by 35 feet.	8,750
Oil house, brick, 25 by 40 feet.	3,400
Carpenter shop and storehouse, 30 by 60 feet.	7,200
Buoy cleaning shed, 20 by 50 feet.	4,000
Buoy skids and chain platform.	4,375
Boundary fence.	2,670
Railroad, push cars, motors.	4,600
Electric-welding set and air compressor.	3,200
Water main.	2,500
Machine-shop equipment.	2,075
Contingencies.	2,384
	208,645
Less amount appropriated by act of July 1, 1918.	85,000
Total.	123,645

No. 40. Great Salt Pond (R. I.) Light Station.—Completing light and fog signal on extreme end of breakwater, Great Salt Pond, R. I., \$53,000.

NOTE.—An appropriation of \$20,000 for this work was made by the act of June 12, 1917 (40 Stat., 161), but on account of increase in cost of labor and material and of changing the location to extreme end of breakwater, with foundation in much deeper water than was previously planned, and in order to make this harbor available for submarines, the funds previously appropriated are insufficient and an additional appropriation is required to complete the work, the original appropriation being only sufficient to construct the foundation in the extra depth of water. Detailed estimate:

Tower, dwellings, and engine room on concrete foundation.	\$36,000
Fog-signal apparatus.	8,500
Illuminating apparatus.	2,100
Installation of fog-signal machinery and illuminating apparatus.	3,100
Oil-storage tanks.	1,300
Incidentals.	2,000
Total.	53,000

No. 41. Inland waterway, Norfolk, Va., to Beaufort Inlet, N. C., aids to navigation.—Establishing and improving aids to navigation to mark the improved inland waterway from Norfolk, Va., to Pamlico Sound, N. C., \$63,000.

NOTE.—The work of the U. S. Engineers on the 12-foot project for inland waterway from Norfolk, Va., to Beaufort Inlet, N. C., has reached a point where it seems certain that an available depth of 12 feet throughout will be available in the early part of 1920. The section from Norfolk, Va., to Albermarle Sound, N. C., is expected to be completed to a 12-foot depth in February, 1920, and pending the completion of the ultimate

project via Alligator River and Pungo River it is proposed to dredge a 12-foot channel through Croatan Sound, N. C., and across Bluff Shoal, N. C., in Pamlico Sound, N. C. Traffic through this waterway is now increasing, and recent reports indicate heavy traffic when the channel is completed. There will have been expended on this project at that time approximately \$3,400,000, and in order to make the same fully available to the anticipated through traffic, it will be necessary to establish about 29 small acetylene lights, 25 unlighted beacons, 14 spar buoys, and 2 gas and bell buoys. These aids will at the same time replace 14 existing lights of an antiquated and inefficient type and which, having been in service about 30 years, are in need of renewal. Detailed estimate:

Pile foundations.....	\$6,885
Rear range towers.....	6,250
Illuminating apparatus.....	29,805
Unlighted beacons.....	3,750
Spar buoys with moorings.....	600
Gas and bell buoys, with moorings.....	14,400
Fender dolphins, 5 at \$262 each.....	1,310
Total.....	63,000

No. 42. *Fairport Harbor, Ohio, aids to navigation.*—Improving the aids to navigation at Fairport Harbor, Ohio, additional to amount appropriated by act of June 12, 1917, \$35,500.

NOTE.—The act of June 12, 1917 (40 Stat., 161), appropriated \$42,000 for improving aids to navigation at Fairport Harbor, Ohio. This estimate contemplated the construction of a new lighthouse on the west breakwater pierhead and installation of a compressed-air fog-signal. Owing to the increased cost of all materials and labor the appropriation is insufficient to carry out the project. Upon completion of the new structure an additional keeper will be required, making three in all. Quarters are now provided for only one keeper. An item has, therefore, been included in this estimate to cover remodeling the old dwelling and building a new double dwelling, providing quarters for the three keepers. Detailed estimate:

Remodeling old dwelling, one keeper.....	\$2,500
New double dwelling, two keepers.....	13,500
Concrete foundation.....	14,000
Superstructure.....	38,000
Illuminating and fog-signal apparatus.....	9,500
	77,500
Less amount appropriated by act of June 12, 1917.....	42,000
Total.....	35,500

No. 43. *Lansing Shoal (Mich.) Light and Fog-Signal Station.*—Establishing a light and fog-signal station at Lansing Shoal, Mich., \$304,000.

NOTE.—This dangerous shoal, which is now marked by a light vessel, is located at the most important point on the northerly passage to and from the Straits of Mackinac. Maritime interests are urgent in their requests for a better light and a more adequate fog-signal, located on a fixed crib. The light vessel is compelled, by reason of ice conditions, to be off her station in the early spring and late fall. The important commerce through this passage, both before the light vessel has been placed on her station and after she is compelled to leave it in late fall, fully warrants that a permanent first-class light and fog signal, rather than a light vessel, be used in this passage. The annual traffic past Lansing Shoal averages not less than 25 to 30 million tons, which reduced to vessel passages on the basis of an average load of 5,000 tons, which is a fair average for traffic on Lake Michigan and Green Bay, would indicate the annual passage of approximately 5,000 vessels in this vicinity. The establishment of this fixed station will permit of the discontinuance of the Squaw Island fog signal and the substitution of an acetylene unattended light for the present Squaw Island Light Station, which will do away with the three keepers and make an annual saving in expense of some \$2,300.

A reinforced concrete foundation pier about 70 by 60 feet by 20 feet high, above water, resting on proper underwater substructure and supporting rectangular steel building, surmounted by third-order lantern house; plane to be about 60 feet above water, equipped with third-order lens and high-power fog signal and submarine bell. Detailed estimate:

Foundation pier complete.....	\$200,000
Steel building, superstructure with lantern house.....	61,000
Boats and boat cranes.....	15,000
Fog-signal apparatus.....	15,000
Illuminating apparatus.....	10,000
Furniture and miscellaneous equipment.....	3,000
	304,000

No. 44. *Two Rivers, Wis., pierhead.*—Improving light and fog signal at Two Rivers, Wis., \$6,000.

NOTE.—This station is now equipped with an electrically operated fog bell and sixth-order lens illuminated by wick-oil light. For several years past there has been an insistent demand from Two Rivers that the fog signal be improved, owing to the fact that craft operating out of Two Rivers found the bell of little assistance in making the port during fog. As it is necessary to maintain two keepers to operate the bell, the operating expense will be increased but little if an adequate and efficient signal is installed. It is proposed to install a diaphone fog signal and electrically driven compressors (current from city) and provide an oil-engine-driven electric generator for emergency use. Also to install electric light in sixth-order lens in place of oil light. Detailed estimate:

Repairs to present wooden tower and to frame power house.....	\$700
Fog-signal equipment.....	5,200
Illuminating equipment.....	100
Total.....	6,000

Total, group No. 2, \$1,377,745 (not included in total of estimates).

DESCRIPTIONS OF NEW WORKS COMPLETED.

PROTECTION OF LIGHT STATIONS, CHESAPEAKE BAY AND POTOMAC RIVER.

Purpose.—During the winter of 1917-18 ice floes wrought an unprecedented amount of damage to screw-pile lighthouses and light stations in the Chesapeake Bay and the Potomac River. It became necessary to build up existing protection works of riprap stone near to and around these stations and construct new ice barriers or breakers of riprap stone to protect the stations.

Sites.—Cedar Point Light Station, Chesapeake Bay, Md., 700 tons of riprap stone were placed on the southeast side of the station along the concrete sea wall to protect same from action of the ice and sea.

Point Lookout Light Station, Potomac River, Md., 700 tons of riprap stone were placed along the shore between high and low water to stop the erosion of the beach and the encroachment of the seas on the buildings of the station.

Ragged Point Light Station, Potomac River, Md., 600 tons of riprap stone were placed to build up a mound to act as an ice breaker for the screw-pile lighthouse.

Blakistone Island Light Station, Potomac River, Md., 400 tons of riprap stone were placed to restore the existing shore protection displaced by ice and storms.

Mathias Point Shoal Light Station, Potomac River, Md., 500 tons of riprap stone were used to construct a new ice breaker and build up an existing ice breaker which was leveled off by the attack of ice floes.

Cost.—The act of March 28, 1918, appropriated \$100,000 for repairing and rebuilding aids to navigation, Atlantic coast. The placing of riprap stone at the stations mentioned above was one of the projects completed from this appropriation in the fiscal year 1919. The work was started November 10, 1918, and completed April 15, 1919. Total amount expended on this project, \$30,066.41.

REPAIR OF SABINE BANK LIGHT STATION, TEX.

Purpose.—The hurricane of August 16-17, 1915, washed the hatches off the main gallery floor about 26 feet 6 inches above mean high water, flooding the cellar. The main gallery roof, the supporting stanchions, and some of the gallery footplates, also the water-closet and landing ladder and hatch on the east side, both boats and one pair of davits, and several plates of the main tower above the gallery roof were carried away. Extensive repairs were required to replace this damage and to make the station proof against similar destructive effects of future storms, so far as possible.

Work accomplished.—A cylindrical wall of heavy, flanged, cast-iron plates, approximately 8 feet high, was erected on the main gallery inclosing a space about 5 feet 6 inches wide extending entirely around the tower. Over this a reinforced-concrete roof was placed, supported on steel T's, which also served to anchor the top of the cast-iron plates to the main tower. Openings are provided in the cast-iron plates for 13 air ports and double steel doors. The air ports are provided with plate-glass windows in hinged metal frames 14 inches in diameter. The remaining gallery space, which is about 3 feet wide, is surrounded by a substantial iron railing. Two new sets of boat davits, extending 18 feet above the main gallery floor, have been installed, with operating platforms accessible from the second story of the tower. With these davits the station boats may be landed on the platforms provided above the roof of the main gallery out of reach of storm waves. Other repairs necessary to put the station in first-class condition have been made.

Cost.—The cost of this work amounted to \$15,047.49 and was paid from special funds provided for repairing and rebuilding aids to navigation, Gulf of Mexico, destroyed by hurricane.

MOVING OF CAPE SAN BLAS LIGHT STATION, FLA.

Purpose.—The erosion of the shore well inside of the former location of the tower made it necessary to move the 98-foot skeleton iron tower to a site 1,857 feet NNE. $\frac{1}{4}$ E.

Site.—The new site is on the next sand ridge to the westward of the station dwellings, and was selected so that the lantern of the tower would be visible above the trees of the cape in all directions from seaward.

Work accomplished.—The light was temporarily discontinued on April 30, 1918, while the tower was being taken down and moved, and was again exhibited in its new location, with focal plane 101 feet above water, on January 22, 1919. An 8-foot walk, with track for flat car, was built from the old to the new site across beach and the inside ravine between ridges, and the sections of the tower were thus expeditiously moved.

Foundation.—A new foundation was built, consisting of nine reinforced concrete blocks 9 feet square by 5 feet 6 inches high, each resting on two rows of 12 by 12 inch timber grillage, which was through-bolted to 12 by 12 inch clamps, bolted to four 38-foot round piles. The grillage, clamps, and piles are long-leaf yellow pine creosoted, 16 pounds of creosote oil per cubic foot. Before the piles were driven the ground in the location of each block was sufficiently excavated to permit the preparation of pile heads and bolting of clamps and grillage. The piles are so driven that the elevation of their tops, between second and top rows of grillage, is at mean-low-water level. The water level in each pit was kept low by sheet piling and pumping, so that access to the pile heads could be had. Additional bolts were provided to anchor the concrete blocks to the grillage. These bolts extended 2 feet into the concrete blocks. The concrete blocks were molded as a monolith, with edges beveled.

Cost.—The total cost of moving tower to new site, including necessary new walks, etc., was \$17,997.67, and was paid from appropriation of \$125,000 made by act of September 8, 1916, for repairing or rebuilding aids to navigation damaged or destroyed by hurricane in the Gulf of Mexico.

AIDS TO NAVIGATION, CARIBBEAN SEA.

Purpose.—Upon the joint request of the Secretary of the Navy and the Secretary of Commerce, the President allotted \$100,000 from the appropriation for national security and defense for the purpose of establishing lights to mark the reefs which lie in the path of vessels between the Yucatan Passage and the Panama Canal.

Structures.—Lights were established and placed in commission in the latter part of June, 1919, on Serrana Bank, Quito Sueno Bank, and Roncador Cay. Each light consists of a 375-millimeter, flashing, acetylene lantern on a 40-foot structural-steel tower. The tower is supported on the top of a steel tank house, having a concrete foundation and providing storage space for the battery of compressed-acetylene tanks which contain a supply of gas sufficient for approximately 12 months' service. Each light is provided with a "sun valve" which automatically cuts off the gas supply during daylight. The effective range of these lights is approximately 12 miles. The erection of these lights was successfully accomplished by a field force from the eighth lighthouse district under the direction of the superintendent on general duty, Lighthouse Service, who was assisted by the officers and crew of the U. S. gunboat *Wheeling*, which vessel carried the party and the materials and equipment from New Orleans to the several locations. The lights being automatic, no keeper is required, but masters of passing vessels have been requested to report their condition as opportunity is presented for observations.

Cost.—The total cost of the establishment of these three lights, exclusive of the services rendered by the Navy Department, amounts to \$26,163.89.

AIDS TO NAVIGATION, LORAIN HARBOR, OHIO.

Purpose.—Owing to the enlargement of the harbor by the construction of offshore breakwaters, a new light with fog signal was required to mark the entrance to the harbor at the end of the west breakwater. The permanent light was placed in commission April 7, 1919, and the fog signal May 13, 1919.

Site.—The station is located at the north end of the west breakwater at the entrance to the harbor.

Structure.—The building is a steel frame structure, with concrete walls about 28 feet square, having two stories and attic, erected on the concrete pierhead. The roof is covered with asbestos shingles, and a monitor for housing the fog signal is built on the northwest roof. The tower rises from the southeast corner of the building and is surmounted by a fourth-order, helical-bar lantern. The power-room floor is of concrete and the floors above are of hardwood. A pipe railing extends around the pier for protection.

Illuminating apparatus.—This comprises a fourth-order revolving lens having three dioptric panels of fixed type, with three alternate panels of double mirrors, mounted on a mercury float pedestal and using a type "A," 35-millimeter, incandescent oil-vapor outfit. The light characteristic is occulting white every 10 seconds, light 5 seconds, eclipse 5 seconds, with candlepower of 7,300. The focal plane is 58 feet above mean lake level, and the light is visible 15 miles.

Fog signal.—The fog signal is a type "C" diaphone, using compressed air. The power plant consists of a 13 horsepower and one 20 horsepower oil engine and compressor unit, operating on kerosene or power distillate. The characteristic is one blast and group of 2 blasts (12) every 30 seconds.

Quarters.—There are three keepers who have quarters in the building while on duty. No quarters for families ashore have yet been provided. The basement contains cistern, coal bin, and storage space. The first floor contains the power room, bathroom, and storeroom. The second floor contains a living room, pantry, a bedroom, and a tank room. The third floor is a storeroom containing the diaphones and timing device, water tank, and stairs leading to lantern.

Cost.—The act of October 22, 1913, appropriated \$35,000 for the work, which was done by hired labor and purchase of materials. Total cost to June 30, 1919, \$34,974.54.

SAND HILLS LIGHT STATION, MICH.

Purpose.—The shore line of Lake Superior off Keweenaw Point and abreast of Eagle River, Mich., is fringed with rocky shoals on which a number of vessels have been wrecked. The purpose of this project is to provide an adequate light and fog signal station to mark these reefs.

Site.—This station is located about 3½ miles west of the town of Eagle River, Mich., on "Five Mile Point." The reservation comprises an area of about 47 acres heavily wooded along the rocky shore line, with sand hummocks inland. The land about the station has been cleared to permit an uninterrupted view of the light and station from seaward.

Structures.—Structures include a combined tower and triple dwelling, fog-signal house, storehouse, boathouse, oil house, and landing dock, all connected by concrete sidewalks.

The combined tower and dwelling, which is the main structure, is of buff-colored, pressed brick. This building consists of a square tower 70 feet high and three separate apartments, which surround it on the front and two sides. The location is about 150 feet inshore on sand foundation. A steel grillage supports the tower proper, which is of fireproof construction throughout, having steel framing, concrete floors, and steel stairs, doors, window sash, and frames. The cornice and ballustrade are cut stone and the lantern deck cast iron. The lantern is of the 7 foot 1 inch diameter helical bar, revised design. The second story of the tower is used as an office by the keepers and has separate entrances into each apartment. The basement, which is accessible from the cellar of each apartment, contains a central heating plant and control valves for the pneumatic water-supply system.

The apartments, or keepers' quarters, have timber floors, partitions, etc., and are provided with fire walls where they adjoin. The roofing material is of copper. The side apartments have each six rooms and the front five rooms, in addition to bath-room, pantry, and basement. All are supplied with cooking stoves, hot and cold water, modern plumbing, and hot-water heat.

The fog-signal house is of hollow tile, with stucco finish, asbestos shingle roof, and concrete floor. Boathouse and barn are frame and oil house of brick, similar to main structure.

Illuminating apparatus.—The illuminating apparatus is a fourth-order, ball-bearing-mounted, flashing lens revolved by a weight-operated clock, producing one flash of 24,000 candlepower every 10 seconds. The light is 91 feet above lake level and is visible approximately 18 miles in clear weather. A type "B," 35-millimeter, incandescent oil-vapor lamp is used.

Fog signal.—The fog signal consists of a duplicate installation of type "F" air diaphones and straight-line, direct-connected air compressors and oil engines; blast, 5 seconds every 30 seconds. The timing mechanism is belt-driven from engines. The audibility is approximately 7 miles under favorable conditions. The cast-iron diaphone resonators project through the gable on the north end of the fog-signal building on a line normal to the traffic lane.

Quarters.—One keeper and two assistants are quartered in the main building described above.

Landing dock and grounds.—A large amount of clearing has been done on the reservation. Sidewalks connect the principal structures and the landing dock, and an industrial track laid for transporting supplies from dock to station buildings. The concrete dock is built along the inside of a reef, where there is from 4 to 6 feet of water, affording good landing facilities for boats delivering supplies. Water for the fog-signal engines is obtained from a well supplied by natural drainage, while water for station use is obtained directly from the lake.

Cost.—The act of June 12, 1917, appropriated \$70,000 for this project. Amount expended to June 30, 1919, \$68,714.69. All work at the station was carried out by hired labor and the purchase of materials, employing the regular district field force. Work was actively commenced in the late fall of 1917; the fog signal was placed in operation on May 15, 1919, and the main light on June 19, 1919.

AIDS TO NAVIGATION, ALASKA.

Purpose.—To meet the demands of the increasing commerce and to continue the work of establishing efficient aids to navigation, eight acetylene lights and one gas and bell buoy were established at various points in Alaskan waters, during the fiscal year ending June 30, 1919. Data relative to these aids are shown in tabular form on the following page.

Quarters.—No quarters were provided. All acetylene lights are of the unwatched type, using compressed acetylene in acetone, supplied from batteries of steel cylinders, which contain a sufficient supply of gas to operate the light continuously between visits of lighthouse tenders.

Cost.—The amount of \$2,618.08 was expended from the appropriation of June 12, 1917, during the fiscal year 1919.

Name of light.	Locality.	Structure.	Illuminating apparatus.	Characteristic.	Intensity of light in candles.	Focal plane above mean high water in feet.	Miles seen.	Approximate cost.	Date of establishment.
Morris Reef Gas and bell buoy.	Chatham Strait.....	Black cylindrical superstructure, 200 millimeters.	Acetylene lens lantern.	Flashing white (flash 0.3 sec., eclipse 2.7 sec.).	130	12	8	\$3,788.00	Dec. 3, 1918
Boat Rock.....	Revillagigedo Channel.	White wooden house on skeleton tower, 200 millimeters.	.....do.....	Flashing white (flash 1 sec., eclipse 9 sec.).	130	46	9	2,304.16	Sept. 1, 1918
Gravina Point.....	Prince William Sound.	White wooden house, 200 millimeters.	.....do.....	Group flashing white (1st flash 0.3 sec., eclipse 0.9 sec.; 2d flash 0.3 sec., eclipse 4.5 sec.).	130	15	9	1,919.20	Sept. 2, 1918
Lemesurier Island.....	Icy Strait.....	.....do.....	.....do.....	Flashing white (flash 1 sec., eclipse 9 sec.).	130	42	9	1,108.79	Sept. 23, 1918
North Inian Pass.....	Icy Strait.....	.....do.....	.....do.....	Flashing white (flash 0.3 sec., eclipse 2.7 sec.).	130	64	9	1,814.06	Sept. 22, 1918
Point Carrew.....	Yakutat Bay.....	.....do.....	.....do.....	Flashing white (flash 0.3 sec., eclipse 2.7 sec.).	130	16	9	1,809.06	Sept. 19, 1918
The Eckholms.....	Sitka Sound.....	White wooden house on concrete base, 200 millimeters.	.....do.....	Flashing white (flash 1 sec., eclipse 9 sec.).	130	33	9	1,794.70	July 13, 1918
Skin Island.....	Clarence Strait.....	White wooden house, L. P. 150 millimeters.	.....do.....	Flashing white (flash 1.0 sec., eclipse 9.0 sec.).	130	33	9	209.67	June 3, 1919
The Brothers.....	Stevens Passage.....	White wooden house on concrete base, 200 millimeters.	.....do.....	Group flashing white (1st flash 0.6 sec., eclipse 1.8 sec.; 2d flash 0.6 sec., eclipse 9 sec.).	130	37	9	1,218.92	May 13, 1919

LIME KILN LIGHT STATION, WASH. (KELLETT BLUFF).

Purpose.—To meet the demands of increasing traffic between Puget Sound, British Columbia, and Alaska for suitable aids in Haro Strait, west coast of San Juan Island.

Site.—The station is located on a point locally known as Lime Kiln Point, on the shore of Haro Strait, westerly side of San Juan Island, Washington Sound, Wash.

Structure.—The main structure consists of a combined light tower and fog-signal building of reinforced concrete built on solid rock, with the base about 20 feet above high water. The light tower has a concrete deck and gallery and is surmounted by a 7 foot 1 inch helical-bar lantern. The focal plane of the light is 29 feet 7 inches above the ground floor. The roof is covered with asbestos shingles.

Illuminating apparatus.—The lens is of the fourth order, having three 60° panels, with a 180° spherical mirror opposite. The lens mounting is a mercury float. A 35-millimeter incandescent oil-vapor lamp is used. The characteristic is a 30,000 candlepower group flash every 10 seconds, visible approximately 13 miles. Kerosene for the lamp is stored in a tank at the foot of the tower and forced to the service-room by compressed air.

Fog signal.—The fog signal is a third-class reed horn operated by compressed air, sounding a group of two blasts every 20 seconds. Compressed air is furnished by a duplicate set of oil-engine-driven compressors.

Quarters.—The quarters, which are situated about 150 yards southeast of the main building, consist of two one-story reinforced concrete dwellings, each containing six rooms, bath, and basement. The roof is of asbestos shingles and the inside walls lathed and plastered. The landing at present is near the fog-signal building, but measures will be taken in the near future to establish a permanent landing place at Deadmans Bay, about one-quarter mile south of the reservation. A plentiful supply of water for all purposes is obtained from a 6-inch well driven in the solid rock about 100 feet southeast of the fog-signal building.

Cost.—The station was established June 30, 1919, under the act of July 1, 1916, appropriating \$40,000 for the purpose. The amount expended to June 30, 1919, was \$38,333.80. The metal work and portions of the millwork were procured by contract, and the balance of the work accomplished by the district force.

POINT MONTARA LIGHT STATION, CALIF.

Purpose.—The usual track of steamers bound to and from San Francisco along this part of the coast during a fog lies between 3 and 4 miles off the station, and it therefore became necessary to install a more efficient fog-signal apparatus, and owing to its importance as a coast light the efficiency of the light was increased by changing from incandescent oil-vapor to electric incandescent. The change in illuminant was effected March 14, 1919. Change in fog-signal apparatus went into commission January 24, 1919.

Change in light apparatus.—The 35-millimeter, I. O. V. lamp was removed, and a 500-watt, type C, Mazda lamp was installed, candlepower increased from 2,900 to 25,000, connected to local service line 120 volts.

Fog-signal apparatus.—The old duplicate steam boilers, engines, and 12-inch steam whistles were entirely removed and 30-horsepower gas engines, direct-shaft connected to rotary compressors, capacity 200 cubic feet per minute at 45 pounds' pressure, were installed in duplicate; 2 vertical air receivers 60 inches diameter, 12 feet high, were installed. The air compressors operate a "G" type air diaphone at 30 pounds' pressure. Diaphone is controlled by a characteristic timer driven by a small air motor.

Cost.—The apparatus and materials were purchased in the open market by informal contract, and the field work was carried out by district foreman, hired labor, and assistance of the keepers. Expense was defrayed out of funds (general expenses, 1919), expended as follows:

Change of illuminant.....	\$249
Change of fog-signal apparatus.....	11, 447
Total.....	11, 696

IMPROVEMENTS, BARTLETT REEF LIGHT VESSEL NO. 13.

Purpose.—To generally overhaul vessel and make necessary alterations for the installation of oil engines to operate power fog signal in tead of former bell fog signal; to improve the lighting and heating systems; to install new water tanks, fire and bilge pumps, and make necessary repairs to strengthen vessel and increase its efficiency.

Work accomplished.—Built and installed oil and water tanks; built two bulkheads and deck house and made necessary rearrangement of quarters; built foundations for and installed new oil engines; installed fog signal with necessary automatic apparatus; furnished and installed two air tanks, also new acetylene lights, new heating system, and fire and bilge pumps; removed standing rigging; repaired mooring chain; placed vessel on dry dock; and made necessary repairs to hull, sheathing, etc.

Cost.—The work was commenced in January, 1918, and completed in April, 1919. The total cost was \$18,694.11.

IMPROVEMENTS AND REPAIRS LIGHTHOUSE TENDER "ARBUTUS."

Purpose.—The inadequate accommodations for inspecting officers on board the tender *Arbutus* and necessity for providing quarters for a wireless operator and space for radio apparatus made it necessary to rearrange the officers' quarters and to construct additional rooms aboard this tender. The vessel was docked and given a general overhauling, the defective sheathing removed, and the hull planking recaulked. The superintendent's quarters were extended forward and a stateroom and bathroom built. The officers' quarters were rearranged and new plumbing, heating, and electric wiring provided. A mess room was built for the officers. The upper deck was recanvased. Extensive repairs in the nature of electric welding to the boilers were executed.

Cost.—The work was done from general expense Lighthouse Service 1918, at a cost of \$27,966.74. It was started May 14, 1918, and completed October 4, 1918.

BOILERS, LIGHTHOUSE TENDER "MARIGOLD."

Installation of new boilers.—New boilers of the Scotch marine type, which has been purchased previously, were installed on this vessel during the closed season of navigation 1918 and 1919. At the same time the breeching was renewed; a large portion of the main deck, which is of wood, was replaced; a new steel derrick mast was constructed and installed; a steel main rail provided in way of the main deck on each side to replace the present wood rail; and the forecastle deck raised and rebuilt in steel, sides being extended up in turtle-deck effect. In addition to the above work, the electric lighting system was overhauled; the Corey telegraph system repaired; the skylight over the after cabin removed and decked over; the mainmast cut down in size and stepped on the cabin deck, as well as other minor repairs.

The above work was done at the Detroit Lighthouse Depot by the field force of the district, the fabrication of new saddles for the boilers, new breeching, the construction of the new mast and the steelwork on the vessel, including the renewal of the main hatch and enlargement of same, being carried out on the vessel. The work of placing the boilers in position and removing the old ones was accomplished by the hiring of a derrick scow at a low cost. The work was commenced promptly after the close of the season, when the vessel was through with the buoy work, and all work was completed in readiness for her resuming her duties at the opening of navigation in spring.

Cost.—The work was carried out under the general-expense appropriation, the total cost of all items being \$17,935.

LIGHTHOUSE TENDER "ELM."

Purpose.—The tender *Elm*, a power-derrick barge, was built for the construction and repair of aids to navigation in Hudson River, N. Y., third lighthouse district.

Structure.—This tender is 101 feet in length overall, with a molded beam of 30 feet, and a displacement of 318 tons when floating at a mean draft of 6 feet 9 inches in salt water. It is a single-deck vessel constructed entirely of wood, except the casing around the engine space. It is fitted with a derrick mast and two booms, one 68 feet long and the other 40 feet long, with gear and tackle operated by a steam-driven hoisting engine supplied with steam by a small vertical boiler. The hoisting engine and derrick mast are located well forward, the booms swinging aft.

Machinery.—The propelling machinery consists of one 3-cylinder, 2-cycle, internal-combustion engine of 150 h. p., using kerosene as fuel. The cylinders are 14-inch diameter, with a stroke of 18½ inches. The engine drives a right-handed four-blade cast-iron propeller 5 feet 6 inches diameter by 3 feet 8 inches pitch. An oil-engine driven air compressor is also fitted to deliver air for running the pumps, blowing whistle, etc.

Quarters.—The complement of the tender is two officers and four men. There are quarters for the two officers and space for eight men, also a spare room for the superintendent or official passengers' use; the mess room, galley, wash room, and water-

closet, all are located in the deck house aft on the main deck. The cargo hold is located under the main deck, and has a capacity of 70 tons. The hoisting engine and boiler are located within a house constructed on the forward end of the main deck. The necessary sanitary appliances, pumping and drainage systems have been provided.

Cost.—This vessel was constructed under the act of July 1, 1916, appropriating \$100,000 for improving aids to navigation and establishing new aids, Hudson River, N. Y. The hull of the vessel was built under contract at East Boothbay, Me., and the cost was \$29,400. The propelling machinery, hoisting engine, derrick, gear, etc., were purchased and installed by the Government for \$64,238. The total cost of the vessel, complete, was \$93,638. The construction was started January 13, 1917, and the vessel was completed and placed in commission July 18, 1919.

LIGHTHOUSE TENDER "PINE."

Purpose.—The tender *Pine* was built for general lighthouse service in the shoal waters and inlets of the New Jersey coast, third lighthouse district.

Structure.—This tender is 60 feet in length overall, with a molded beam of 15 feet and a displacement of 56 tons when floating at a mean draft of 4 feet 4 inches in salt water. It is a single, open-deck vessel, constructed entirely of wood. It is fitted with a special A frame derrick, with boom and gear complete, which is operated by a gasoline-engine driven hoister, located just aft of amidships and immediately forward of the pilot house and trunk cabin.

Machinery.—The propelling machinery consists of one 50 h. p. 4-cylinder, 4-cycle gasoline engine, having cylinders 7½ inches in diameter and 10-inch stroke, driving a right-hand 3-blade bronze propeller 36 inches in diameter by 40 inches pitch. There are also provided two gasoline tanks of 300 gallons total capacity, and two fresh-water tanks of 300 gallons total capacity. Necessary sanitary appliances and bilge drainage pipes have been provided.

Quarters.—The complement of the tender is two officers and three men. Berths are provided in the after part of the pilot house and in the trunk cabin under the pilot house for the officers and men, respectively. The cargo hold is located under the main or buoy deck forward and has a capacity of 16 tons.

Cost.—This tender was constructed under the appropriation "General expenses Lighthouse Service, 1918," the vessel being built under contract at Nyack, N. Y.; the contract price was \$9,500. An A frame derrick with boom and gear, operated by a gasoline hoisting engine, was purchased and installed by the Government at a cost of \$6,687. The construction was commenced June 27, 1918, and the vessel completed and placed in commission November 11, 1918, at Tompkinsville, N. Y.

SUMMARY OF IMPORTANT CONSTRUCTION AND REPAIR WORK UNDER GENERAL APPROPRIATIONS COMPLETED DURING FISCAL YEAR 1919.

Station.	Cost.	Character of work.
FIRST DISTRICT.		
Tender Hibiscus.....	\$10,029	Docking vessel, repairing hull, boilers, machinery, heating system, lighting and piping, also making alterations to houses, etc., to accommodate radio outfit and attendants.
Portland Light Vessel, No. 74.....	3,425	Docking vessel, repairing hull, retubing and repairing boilers, repairing machinery, and installing new pump.
Little Diamond Island Lighthouse Depot, Me.	4,268	Renewing part of bearing and fender piles, caps, braces, and dock.
Seguin Light Station, Me.....	1,038	Installing hot-water heating plants in both sets of quarters in brick house.
SECOND DISTRICT.		
Tender Mayflower.....	6,735	Docking, cleaning, painting, etc.
Tender Anemone.....	2,764	Docking, painting, etc.
Boston Light Station, Mass.....	4,351	Installing oil engines and air compressors and making necessary alterations to buildings.
Light Vessel No. 42.....	4,900	Docking, cleaning, etc.
Light Vessel No. 86.....	1,015	Docking, painting, etc.
Pig Rocks Light, Mass.....	2,243	Establishing acetylene light in place of beacon.
Canal Channel Light No. 8, Mass.....	2,000	Protecting site with riprap.
Canal Channel Light No. 16, Mass.....	2,500	Do.
Canal Channel Light No. 15, Mass.....	2,500	Do.
Canal Channel Light No. 18, Mass.....	1,750	Do.
Canal Channel Light No. 20, Mass.....	3,000	Do.
Canal Channel Upper Range, Mass.....	3,500	Do.

SUMMARY OF IMPORTANT CONSTRUCTION AND REPAIR WORK UNDER GENERAL APPROPRIATIONS COMPLETED DURING FISCAL YEAR 1919—Continued.

Station.	Cost.	Character of work.
THIRD DISTRICT.		
General depot	\$1,029	Retubing boiler (No. 1), power house.
Do.....	1,078	Installing new concrete roadway around new carpenter shop and in front of same.
Do.....	3,711	Rearranging drainage and sewer system made necessary by building new office building.
Absecon Light Station, N. J.....	1,050	General repairs to keeper's quarters.
Borden Flats Light Station, Mass.....	1,315	Replacing wooden walls to kitchen coal bin and privy with tile. Providing and installing water-closet.
Eatons Neck Light Station, N. Y.....	1,951	Renewing concerte deck, main gallery.
Execution Rocks Light Station, N. Y.	2,498	Reshingling roof, renewing gutters, and making various repairs.
Sakonnet Breakwater Light Station, R. I.	1,420	Temporary compressed air siren installed Dec. 17, 1918, in place of former fog signal destroyed by fire.
Tender Daisy.....	1,818	Establishing flashing acetylene light on breakwater.
Tender Mistletoe.....	4,562	Repairs to damaged bow and annual docking and painting.
Tender Myrtle.....	2,422	Annual overhauling and repairs.
Tender Pine.....	6,687	Putting in dry dock and repairing sheathing metal.
Tender Tulip.....	4,242	Installing derrick, hoister, etc., to complete vessel for service.
Do.....	5,338	Docking and painting, installing new propeller blades, repairing boilers, hull, and machinery and installation.
Do.....	2,922	Docking, painting, and general repairs.
Scotland Light Vessel No. 11.....	7,785	Building and installing new steel derrick boom, and general repairs to hull and machinery.
Bartlett Reef Light Vessel No. 13.....	8,067	Docking, repairing sheathing metal, building wireless room, installing acetylene lights, etc.
Ram Island Reef Light Vessel No. 23...	3,681	Placing vessel in dock and repairing keel, sheathing metal, etc.
Northeast End Light Vessel No. 44....	2,487	Docking and necessary repairing.
Cornfield Point Light Vessel No. 48....	1,312	Docking and general repairing of hull and machinery.
Fire Island Light Vessel No. 68.....	3,250	Docking and repairing sheathing metal; also general repairs to hull and machinery.
Overfalls Light Vessel No. 69.....	1,950	Installing acetylene lights in place of present electric lights and general repairs to hull and machinery.
Relief Light Vessel No. 78.....	2,468	General repairs and annual overhauling.
Five Fathom Bank Light Vessel No. 79.	4,080	Docking and repairing damages caused by collision.
Ambrose Channel Light Vessel No. 87..	1,313	Docking and painting, general repairs to hull and machinery, and rearranging houses for wireless.
FOURTH DISTRICT.		
Edgemoor Lighthouse Depot, Del.....	1,929	Docking, painting, and general repairs.
Schooner Ledge Range Rear (unused) Light Station, Pa.	2,185	Thirty-two wharf fender piles put in place, and buildings painted two coats.
Cape Henlopen Light Station, Del.....	5,483	Tower dismantled and put on cars for rail shipment.
Tender Iris.....	29,615	Bulkhead erected and groynes repaired.
Tender Woodbine.....	3,431	General repairing; cylinders rebored; new liner made and fitted, etc.
FIFTH DISTRICT.		
Chincoteague Lighthouse Reservation, Va.	3,285	Old sheathing removed from hull and resheathed; cylinders of engine opened; new rings made.
Buoyage.....	3,017	Building concrete retaining wall; installing boat davits.
Dutch Cap Cutoff Light, Va.....	1,554	Converting two type C buoys to use compressed acetylene gas.
Cape Lookout Light Vessel No. 80.....	9,269	Establishing acetylene light; discontinuing light station.
Tender Juniper.....	1,785	Docking, painting, and making minor repairs to hull and machinery.
Tender Jessamine.....	19,331	Overhauling boilers, making repairs to deck by district force.
Tender Arbutus.....	27,967	Docking, repairing deck, hull, and boilers.
Relief Light Vessel No. 49.....	15,676	Docking vessel and altering and improving quarters.
Tender Laurel.....	5,238	Docking, replanking hull, and making general repairs.
Tail of Horse Shoe Light Vessel No. 46.	3,864	Docking, repairing sheathing, etc.
Winter Quarter Light Vessel No. 91....	6,203	Docking, painting, and making minor repairs.
Working barge.....	3,956	Do.
Working barge and pile driver.....	8,415	Building deck house and installing plumbing.
North River Bar Range Lights, N. C..	2,367	Docking, resheathing, making general repairs to hull.
Tender Columbine.....	1,190	Rebuilding front light and increasing intensity of both lights.
		Docking, cleaning, painting, and making minor repairs.

SUMMARY OF IMPORTANT CONSTRUCTION AND REPAIR WORK UNDER GENERAL APPROPRIATIONS COMPLETED DURING FISCAL YEAR 1919—Continued.

Station.	Cost.	Character of work.
SIXTH DISTRICT.		
Charleston Light Station, S. C.....	\$1,972	Rebuilding walk from wharf to station, increasing size of wharf, raising tramway to boathouse, and minor repairs.
Hunting Island Light Station, S. C....	2,928	General repairs to buildings and tramway.
Tender Cypress.....	2,560	Docking, cleaning, painting, and overhauling, and repairing boilers and machinery.
Tender Palmetto.....	2,417	Docking, cleaning, painting, repairing steering gear, machinery, and electric-lighting equipment.
Martins Industry Light Vessel No. 1...	3,387	Docking and renewing hull sheathing, new rudder, etc.
Brunswick Light Vessel No. 84.....	6,605	Docking, cleaning, painting, installing new main condenser, machinery repairs, etc., at Charleston Navy Yard.
Relief Light Vessel No. 53.....	2,430	Docking, cleaning, painting, repairing hull, boilers and machinery.
SEVENTH DISTRICT.		
Beacons and unattended lights.....	3,113	Making minor repairs to and painting.
Inside Route Beacons (Miami to Long Key, Fla.).	1,778	Establishing 93 single pile beacons.
Miami and Cape Florida Channels, Fla.	5,416	Establishing 3 triangular, pyramidal, wooden structures and 17 5-pile dolphins with minor lights, and 54 single-pile beacons.
Pine Island Sound Lights Nos. 4, 8, 14, 3, 19, and 15, Fla.	1,208	Replacing single piles with 5-pile dolphins.
Southwest Channel Light, Fla.....	1,430	Rebuilding structure.
Tender Ivy.....	3,937	Docking vessel, scaling and painting hull, overhauling and repairing main engines, and repairing 2 dynamos; rearranging quarters of crew and petty officers; making various repairs.
Tender Snowdrop.....	3,528	Renewing all cabin and house work; minor repairs to hull and machinery.
EIGHTH DISTRICT.		
Galveston Jetty Light Station, Tex....	8,733	1,093 tons of rock were placed around foundation.
Heald Bank Light Vessel No. 81.....	3,982	General repairs to hull and machinery.
Southwest Pass Light Vessel No. 102...	1,212	Minor repairs to hull and machinery.
West Pass Cut Range Lights, Fla.....	2,364	Rebuilding both 4-pile iron-cased structures.
Tender Camellia.....	3,650	Docking and repairing.
Tender Magnolia.....	24,034	General repairs to boilers, hull, and machinery.
NINTH DISTRICT.		
Tender Lilac.....	2,755	Installing creosoted wooden false keel, docking vessel, and painting hull.
TENTH DISTRICT.		
Buffalo Lighthouse Depot.....	5,494	Extensive repairs to old boat slip and wharf.
Cleveland East Entrance Light Station, Ohio.	6,262	Providing new steel tower and installing diaphone in place of electric siren fog signal.
Cleveland West Pierhead Light Station, Ohio.	1,365	Improvement to fog signal building.
Galloo Island Light Station, N. Y.....	3,384	Rebuilding wharf (timber).
Lorain West Breakwater Pierhead Light Station, Ohio.	5,530	Improvements to structure, installing fog signal apparatus, and necessary repairs.
Oswego Light Station, N. Y.....	2,424	Extensive repairs to foundation crib and minor repairs to boathouse.
Praesque Isle Fog Signal Station, Pa....	1,196	Repairs and improvements to fog-signal house.
Tender Crocus.....	4,617	Docking, painting, miscellaneous repairs and improvements, and repairing cargo boat.
ELEVENTH DISTRICT.		
Tender Marigold.....	17,935	Installing new boilers; replacing breeching; overhauling machinery; building and installing new steel mast; raising fore-castle head; enlarging main hatch; renewing greater part of main deck; installing steel main rail and making minor repairs.
Windmill Point Light Station and Windmill Point Range Light Station, Mich.	2,502	Raising front and rear towers, 15 and 20 feet, respectively installing bathrooms in each dwelling; installing electric lights in dwellings and towers.
Clinton River Range Lights, Mich.....	1,453	Building new tank house and mast at front light and installing A. G. A. light at both front and rear lights.
West Neetish Channel Light No. 5, Mich.	1,655	Rebuilding pile-light structure in readiness for new lighting.
Au Sable Light Station, Mich.....	1,146	Repairing and rebuilding landing dock.
Big Bay Light Station, Mich.....	1,297	Repairing and rebuilding landing dock at boathouse placing new fog signal doors.
Outer Island Light Station, Mich.....	3,809	Repairing and rebuilding landing dock, repairing tramway and making minor repairs around station.
La Pointe Light Station, Mich.....	1,670	Repairing landing dock; installing electrically controlled fog bell, and telephone.

SUMMARY OF IMPORTANT CONSTRUCTION AND REPAIR WORK UNDER GENERAL APPROPRIATIONS COMPLETED DURING FISCAL YEAR 1919—Continued.

Station.	Cost.	Character of work.
TWELFTH DISTRICT.		
South Fox Island Light Station, Mich..	\$1,997	General repairs to station buildings; dock rebuilt and complete system concrete walks placed.
Frankfort Pierhead Light Station, Mich.	5,325	Fog signal improved by installing electric driven air compressor and air diaphone to replace blower siren. Front and rear range lights improved by installing electric lamps to replace wick oil lamps.
Portage Lake Pierhead Light Station, Mich.	1,137	Front light of range discontinued; rear light changed from oil to unwatched acetylene and elevated walk removed. Keeper discontinued.
Pentwater Pierhead Light Station, Mich.	1,783	Front and rear lights of range changed from oil to acetylene and elevated walk removed. Keeper discontinued.
St. Joseph South Pier Light Station, Mich.	3,557	New light established; concrete foundation constructed and skeleton steel tower erected and acetylene light apparatus installed.
Waukegan Harbor Light Station, Ill...	1,262	Two bathrooms built in first story of double dwelling and fixtures moved from basement. Minor repairs to fog-signal building. Concrete sea wall built about base of breakwater tower.
Pottawatomie Light Station, Mich., and Suel Choix Pointe Light Station, Mich.	2,492	Two launches, with engines, contracted for to replace two worn out.
Green Island Light Station, Wis.....	1,780	Replacing old launch with a new one.
Tender Sumac.....	1,483	Do.
Do.....	2,117	General repairs to hull, boilers, and machinery.
Relief Light Vessel No. 98.....	1,164	Hull of vessel provided with an insulating lining, and heating system improved.
THIRTEENTH DISTRICT.		
Barge for tender Dandelion.....	7,150	Constructing barge.
FIFTEENTH DISTRICT.		
Tender Oleander.....	7,808	Rebuilding boiler deck; building and installing new heaters; rebuilding cold storage room and furnishing and installing new brine tank; rewiring in conduit; renewing main and branch steam lines; and renewing auxiliary steam pipe.
SIXTEENTH DISTRICT.		
Mary Island Light Station, Alaska.....	1,158	Building addition to boathouse, installing new turntable, making miscellaneous repairs about station.
Tree Point Light Station, Alaska.....	1,785	Miscellaneous repairs to tower, dwellings, and tram.
Tender Cedar.....	5,460	Docking, cleaning, painting, general repairs, and improvements.
Tender Fern.....	3,900	Docking, cleaning, painting, general repairs, including enlargement of deck house and installation of wireless apparatus.
SEVENTEENTH DISTRICT.		
Browns Point Light Station, Wash.....	2,010	Repairing buildings, fencing grounds, and grading.
Robinson Point Light Station, Wash....	6,268	General repairs to assistant keeper's dwelling, grading of roads, etc. Illuminant and motive power of fog signal changed to electricity.
Tender Manzanita.....	2,016	Installing steel fore topmast, docking, cleaning, and painting, and general repairs to machinery.
Tender Heather.....	1,276	Docking, cleaning, and painting, also overhauling of steering engine.
Tender Rose.....	1,066	Docking, cleaning, and painting, and installation of ventilator and additional sanitary fittings.
Columbia River Light Vessel No. 88....	1,895	Docking, cleaning, painting, and general overhauling.
Relief Light Vessel No. 92.....	3,668	Do.
Swiftsure Bank Light Vessel No. 93....	4,383	Do.
EIGHTEENTH DISTRICT.		
Alviso Channel Light 10, Calif.....	1,486	Establishing a 3-pile beacon and acetylene light.
Crescent City Entrance Gas and Bell Buoy No. 2, Calif.	2,200	Establishing gas and bell buoy.
Humboldt Bay Fog Signal and Lights, Calif.	1,042	A 30-foot extension to present landing dock was built.
Humboldt Bay Fog Signal and Lights, Calif.	1,721	Brush fascines were laid and covered with heavy riprap stone to protect timber revetment and sheet piling from action of heavy seas.
Lighthouse Depot, Goat Island, Calif...	1,887	Two-room additions were built to the machinist's and blacksmith's quarters.
Mile Rocks Light Station, Calif.....	1,222	Installing air diaphone in place of 10-inch air whistle.
North Channel Gas Buoy, No. 1, Calif..	1,050	Establishing a type S acetylene-gas buoy.
Point Arena Light Station, Calif.....	2,039	Installing air diaphone in place of air siren.

SUMMARY OF IMPORTANT CONSTRUCTION AND REPAIR WORK UNDER GENERAL APPROPRIATIONS COMPLETED DURING FISCAL YEAR 1919—Continued.

Station.	Cost.	Character of work.
EIGHTEENTH DISTRICT—continued.		
Point Montara Light Station, Calif.	\$11,437	Installing air diaphone, distillate engines, and rotary air compressors in duplicate in place of duplicate steam boilers and 12-inch steam whistles.
San Mateo Light No. 2, Calif.	1,390	Establishing a 3-pile beacon and acetylene light.
Santa Cruz Light Station, Calif.	1,060	Building new entrance gateways (2) and rebuilding outer reservation fence.
San Pedro Entrance Light No. 2, Calif. ..	1,422	Structure rebuilt and oil equipment changed to acetylene equipment.
St. George Reef Light Station, Calif.	1,228	Electric-driven motor hoist, in portable housing, to lift up station launch on landing dock at Crescent City.
Tender Madrono.	3,872	Installing radio set.
Do.	1,043	Docking, general overhauling, and repairs to hull, boilers, engine, and machinery.
Relief Light Vessel No. 76.	1,274	Do.
San Francisco Light Vessel No. 70.	3,102	Docking, general overhauling and repairs to hull, boilers, engine, and machinery, including renewing of entire lower part of 1 bulkhead.
NINETEENTH DISTRICT.		
Makapuu Point Light Station, Hawaii.	2,568	Repairs to over five miles of station roadway; erected 900 feet of fence on cliff roadway, using reinforced concrete posts. Screened three dwellings; renewed damaged sections and painted about two miles of pipe line; erected a fence around the tower; increased size of paddock at barn with rock fill; and made repairs to reservation and station roadway.

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ANNUAL REPORT
OF THE
COMMISSIONER OF LIGHTHOUSES

TO THE
SECRETARY OF COMMERCE

FOR THE
FISCAL YEAR ENDED JUNE 30, 1920



WASHINGTON
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1920

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REPORT

OF THE

COMMISSIONER OF LIGHTHOUSES.

DEPARTMENT OF COMMERCE,
BUREAU OF LIGHTHOUSES,
Washington, September 15, 1920.

SIR: The following report is submitted of the operations of the Lighthouse Service for the fiscal year ended June 30, 1920:

SUMMARY OF MORE IMPORTANT ACTIVITIES OF THE YEAR.

The total number of aids to navigation maintained by the United States Lighthouse Service at the end of the fiscal year was 16,324, a net increase during the year of 256. There was an increase of 28 in the number of gas buoys. In Alaska there was an increase of 60 aids, of which 16 were lights; the total number of aids to navigation in Alaska is now 535, as compared with 160 ten years ago. The most important new works completed during the year were the range lights for Chester and Marcus Hook Channels in the Delaware River, the light and fog signal at Manitowoc Breakwater, Wis., the light and fog signal near Cape Charles City, Va., and the light tower at Huron Harbor, Ohio. Important improvement works were in progress on the St. Johns River, Fla., the Mississippi River below New Orleans, the St. Marys River, Mich., at two light stations in Porto Rico, at Keweenaw Waterway, Lake Superior, Conneaut Harbor, Ohio, and two stations on the Florida Reefs.

On June 5, 1920, Congress passed an act authorizing \$5,000,000 for a building program to replace vessels of the Lighthouse Service, which are worn out in service and should be condemned, or which have been lost through various casualties, but one new light station being included in the estimates; no appropriation has as yet been made however. Under other appropriations contracts were made for two tenders and one light vessel, and a small vessel was transferred from the Navy for use as a tender.

Active progress is being made, in cooperation with the Bureau of Standards, in the development of radio fog signals at lighthouses, and the tests made near the end of the fiscal year give indication of success in what it is hoped will be an important addition to the safeguarding of navigation through radio fog signals from lighthouses.

More complete statements as to the foregoing are made on the following pages.

SUMMARY OF MORE URGENT NEEDS OF THE LIGHTHOUSE SERVICE.

1. Revision of pay schedules is urgently needed so as to bring about a just relation according to duties and responsibilities between the

various employments in this Service, and in comparison with other Government and outside employment, and to take account of the depreciated purchasing power of the dollar; most of the readjustments of pay that it has been possible to make under the appropriations have not met the needs, and certain classes, particularly the Bureau force in Washington, have shared little or not at all in advances since conditions before the war.

2. Provision is urgently needed for replacing many of the vessels of the Lighthouse Service which have been lost or worn out in service or which will soon have to be condemned, as well as for adding reasonable vessel equipment to meet the considerable increase of the past 10 years in the aids to navigation maintained.

3. Increased maintenance appropriations are urgently needed to meet the continued increase in cost of supplies and labor and to enable proper repair and care of the great amount of exposed property, including vessels, under the charge of this Service.

4. Provision is greatly needed for improved depot facilities in several of the districts, particularly at or near Norfolk, Va.; Key West, Fla.; Honolulu, Hawaii; and Newport, R. I.; and additional funds are needed for the completion of the important depots at Boston, Mass., and Charleston, S. C.

5. Legislation is greatly needed extending the retirement system in the Lighthouse Service to cases of disability incident to the work other than injury received in the line of duty, already provided for.

More complete explanations of these and other recommendations are given later in this report.

PROGRESS OF THE LIGHTHOUSE SERVICE IN THE PAST 10 YEARS.

A brief summary is given below, of the progress of the United States Lighthouse Service in the 10 years, July 1, 1910, to June 30, 1920.

AIDS TO NAVIGATION.

Statistics as to increase in total number, in improved types, and in aids in Alaska.

Class.	July 1, 1910.	June 30, 1920.	Increase in 10 years.
Aids to navigation, total number.....	11,713	16,324	4,611
Gas buoys.....	225	582	357
Lighthouses equipped with oil vapor lamps.....	80	320	240
Lights changed from fixed to flashing.....			334
Fog signals (including submarine bells, but not buoys).....	540	584	44
Whistling and bell buoys.....	303	522	219
Alaska, total number of aids.....	160	535	375
Alaska, total number of lights.....	37	196	159

Discontinuance of unnecessary aids, in the interest of economy, has been given careful consideration, a total of 4,755 having been discontinued during the 10 years. The increases above given are net increases, the total number of new aids established having actually been 9,366 in the 10 years. The total number of light-vessel stations has diminished from 54 in 1910 to 49 in 1920, seven vessels having been replaced by other efficient aids, at a considerable saving, and two new vessel stations established.

The number of automatic gas lights on fixed structures has increased in the period 1910 to 1920 from 98 to 663. The important resulting economy in wage and other expense is shown by the diminution in the same period in the number of light keepers from 1,530 to 1,471, and in the number of stations with resident keepers from about 780 to 721. Allowing for new stations with keepers which have been established, keepers have been discontinued at about 80 stations because of the introduction of automatic apparatus.

A list of the more important new aids to navigation established, with year of completion, follows:

Cape Hinchinbrook, Alaska, light and fog-signal station.....	1910
White Shoal, Lake Michigan, light and fog-signal station.....	1910
Rock of Ages, Lake Superior, light and fog-signal station.....	1910
Split Rock, Lake Superior, light and fog-signal station.....	1910
North Manitou Shoal, Lake Michigan, light vessel.....	1910
Milwaukee, Lake Michigan, light vessel.....	1912
Livingstone Channel lighting system, Detroit River.....	1912
Punta Gorda, Calif., light and fog-signal station.....	1912
Staten Island, N. Y., light station.....	1912
Miah Maull, Delaware River, light and fog-signal station.....	1913
Superior Entry, Lake Superior, light and fog-signal station.....	1913
Alki Point, Wash., light and fog-signal station.....	1913
San Pedro, Breakwater, Calif., light and fog signal station.....	1913
Kilauea Point, Hawaii, light station.....	1913
Roundout Creek, Hudson River, light and fog-signal station.....	1915
Point au Fer Reef, La., light and fog-signal station.....	1916
Cape St. Elias, Alaska, light and fog-signal station.....	1917
Navassa Island, West Indies, light station.....	1917
Sand Hills, Lake Superior, light and fog-signal station.....	1919
Lorain Harbor, Ohio, light and fog-signal station.....	1919
Lime Kiln, Wash., light and fog-signal station.....	1919
Caribbean Sea, reef lights.....	1919
Galveston Jetty, Tex., light and fog-signal station.....	1920

A list of important stations entirely rebuilt, with year of completion, follows:

Lloyds Harbor, N. Y., light and fog-signal station.....	1912
Buffalo, Lake Erie, light and fog-signal station.....	1914
Brandywine Shoal, Delaware River, light and fog-signal station.....	1914
Thimble Shoal, Va., light and fog-signal station.....	1914
Ashland Breakwater, Wis., light and fog-signal station.....	1916
Manitowoc, Wis., light and fog-signal station.....	1920

OTHER GENERAL FEATURES OF PROGRESS.

In the World War the Lighthouse Service gave active cooperation to the Navy and War Departments. Under the act of August 29, 1916, which authorized the President in a national emergency to transfer portions of the Lighthouse Service, he on April 11, 1917, transferred a considerable number of units to the War and Navy Departments, and eventually there were transferred to the Navy Department 46 tenders, 4 light vessels, and 21 light stations, with their personnel, a total of 1,132 persons; these remained in this status until July 1, 1919, at the same time continuing their lighthouse duties so far as possible. A considerable amount of other assistance was rendered by the Service to the military departments, and many other persons in the Lighthouse Service volunteered for military or naval service.

During this 10-year period, the number of lighthouse tenders equipped with radio has increased from 1 to 27, the number of light

vessels so equipped has increased from 4 to 42, and the number of light stations having telephone communication has increased from 166 in 1915 to 274 in 1920. The light vessels and some of the tenders have been equipped by the Navy Department, and many of the light stations by the Coast Guard.

The first conference of district officers of the Lighthouse Service was held in 1914. The publication of a monthly Lighthouse Service bulletin as a means of official communication throughout the Service was commenced in January, 1912.

PERSONNEL OF THE LIGHTHOUSE SERVICE.

Total number of officers and employees July 1, 1910, 5,750 (approximate); June 30, 1920, 6,002, an increase of 248, or only 4 per cent, as compared with increase of 39 per cent in number of aids to navigation maintained. Every appointment and promotion in the Service in this period has been made in accordance with civil-service rules or principles, and on a strictly merit basis.

The following is a summary of measures for relief of personnel:

Reimbursement of keepers and masters authorized, for food and clothing furnished shipwrecked persons, law 1911.

Medical handbook for stations and vessels, published, 1912.

Commutation of subsistence on vessels authorized, law 1912.

Compensation authorized for injuries for persons in hazardous employment in the Lighthouse Service, law 1912.

Leave of absence for per diem employees authorized, law 1915.

Medical relief authorized for light keepers at hospitals of the Public Health Service, law 1916.

Retirement system authorized for the field force of the Lighthouse Service, law 1918. (This was the first civil retirement legislation under the United States Government.)

Payment of travel expenses authorized for teachers of children of light keepers, law 1918.

Increase of rations and compensation of light keepers, and compensation of district officers, law 1918.

Increases of compensation, though for the most part inadequate and not evenly distributed, have been made to meet recent living conditions, so far as appropriations have permitted.

On all vessel construction and alteration work, improved accommodations for officers and crews have been considered.

APPROPRIATIONS AND FINANCES.

The total maintenance appropriations of the Lighthouse Service for the fiscal year 1911 were \$5,471,110, and for the fiscal year 1921, \$7,837,290. The total increase is 42 per cent, approximately the same percentage as the increase during the same interval in the number of aids to navigation maintained by the Service. This increase has been practically all since the fiscal year 1917, but has been insufficient to meet the increased costs required for proper maintenance under present conditions, and the appropriation as above for 1921 will not maintain the Service for the fiscal year.

The average annual appropriation for special works during this 10-year period has been \$785,835. During the latter half of the period, however, this has been quite insufficient for the necessary replacement of vessels worn out in service. The number of lighthouse tenders in 1910 was 51 and in 1920, 55; but this apparent increase is in smaller vessels, and the average age of the vessels is greater. The number of light vessels in 1910 was 68 and in 1920, 62; but there has also been a diminution in the number of stations of 5; the average age of the light vessels has increased.

Commencing with July 1, 1911, a cost-keeping system has been maintained in the Lighthouse Service, showing in reasonable detail the cost of maintaining the principal units, or groups of units, of the Service, and classifying the purpose of all expenditures of funds provided for the Service.

SPECIAL LEGISLATION NEEDED.

INCREASE OF STATUTORY SALARIES.

The legislation most urgently needed for the Lighthouse Service at the present time is a revision of the salaries now fixed by statute, and other legislation for improving the status of the personnel, so as to permit the Service to again attract, as it formerly did, a high grade of faithful and efficient employees. The apparent increase in appropriations required to do this will in the end result in economy for the reason that in the carrying on of highly technical work such as that of the Lighthouse Service there is great waste through loss of time and ineffective work, when, as become more and more the case in the last few years, the Service does not offer sufficient inducements in the way of compensation to attract to it a personnel suited to its special needs, nor to retain for long the best of those who do enter it. Unless early relief is afforded, the conditions in this Service will steadily grow worse, as the proportion of trained and efficient personnel diminishes through natural causes and through resignations of valuable employees who, hoping for improved conditions, have thus far remained with the Service notwithstanding better opportunities.

Congress has recognized the importance of the problem through the appointment of the Congressional Joint Commission on Reclassification of Salaries, which made a report on March 12, 1920. This report fully shows the need of readjustment of salaries and systematic grading of positions. While Congress has as yet taken no action on this report, it did at the last session grant substantial increases of compensation for several services of technical character, as, for example, the officers of the Army and the Navy were given by the act of May 18, 1920, increases of from 15 to 30 per cent over their former base pay, which, including allowances, was already on a basis substantially higher than in the civilian technical services. By the same act the officers of the Coast Guard received the same increases as those of the Army and Navy, and that part of the enlisted personnel of the Coast Guard which mans the life-saving stations was given increases of from 25 to 100 per cent. The field officers of the Coast and Geodetic Survey were by the same act given an average increased compensation over their previous pay of over 110 per cent. Technical officers of the Reclamation Service have recently received, under lump-sum appropriations, increases in salaries of from 15 to 30 per cent. The respon-

sibilities, technical requirements, and duties of various portions of the Lighthouse Service are quite comparable with various groups in each of the services mentioned, and so far as the military needs of the country enter into the question of compensation, the situation fully justifies equal consideration for the personnel of the Lighthouse Service. The act of August 29, 1916, providing for transfer of the Lighthouse Service in the discretion of the President to the Navy or War Department in a national emergency is practically identical with the law as to the Coast and Geodetic Survey, and is effectively similar to that for the Coast Guard, and under this law the President actually transferred 1,132 persons of the Lighthouse Service during the recent war, and they, with 50 vessels, and 21 stations, remained on duty with the Navy for over two years.

From the practical standpoint the situation simply is that with increases of food and other living expenses of 100 per cent and more the dollar now represents but 50 cents of its former value, and the salaried classes of persons in the Lighthouse Service, particularly those whose salary is limited by statute, are not able to sustain their families and themselves in the reasonable manner to which they are entitled, and the pay formerly fixed led them to expect.

The specific relief legislation now needed is a readjustment of the salaries as fixed by law for the officers of the Lighthouse Service in the acts of June 17, 1910, June 20, 1918, and June 5, 1920, and the average salaries of light keepers as now fixed by the act of June 20, 1918, of course coupled with appropriations sufficient for the proper readjustment also of all salaries dependent on lump-sum appropriations and those fixed in appropriation acts.

INCREASE OF RATION ALLOWANCE FOR LIGHT KEEPERS.

The commutation of ration allowance authorized by the act of June 20, 1918, at 45 cents per day, is now quite insufficient to purchase food for one person for a day, and legislation is needed authorizing its increase to an amount reasonably sufficient for the purpose.

PROVISIONS FOR RETIREMENT FOR DISABILITY, AND OTHER CHANGES IN LIGHTHOUSE SERVICE RETIREMENT LAW.

The act of June 20, 1918, providing for retirement of certain classes of persons in the Lighthouse Service has proved beneficial both to the Service and the persons affected. The general retirement law of May 22, 1920, covers most of the persons in this Service excepted from the special law and will also be of broad benefit.

For the persons in the Lighthouse Service covered by the act of June 20, 1918, it is very desirable that the retirement provisions be extended to cover cases, not due to vicious habits or misconduct, where an employee is found to be disabled for useful service before reaching the age fixed in the act. Because of the responsible and arduous character of much of the work, especially on vessels and at light stations, such provisions will add materially to the efficiency of the Service, and relieve cases of serious hardship now arising. There is provision for retirement of persons incapacitated for duty in the Coast Guard and in the Army and Navy. In the general civil-service retirement law of May 22, 1920, there is provision for retirement for disease or injury not due to vicious habits, after 15

years' service. Persons coming under the act of June 20, 1918, are the only ones in the military or civil service of the Government to whom some such provision does not now apply, and legislation is needed to remedy this.

Some other modifications in the retirement law are desirable in the interest of efficient organization.

EXTENSION OF MEDICAL RELIEF FOR LIGHTKEEPERS.

Lightkeepers are now entitled to medical relief at hospitals and stations of the Public Health Service. These hospitals are, however, inaccessible for a large number of lightkeepers who are stationed at remote or isolated points. Equal benefits should be extended to all lightkeepers, and legislation is needed to provide medical relief for all, and this has been concurred in by the Secretary of the Treasury.

OTHER MEASURES FOR RELIEF OF PERSONNEL.

Legislation is needed to permit the adjustment, within a moderate amount, of claims by lighthouse employees for loss or damage to personal property, such as clothing, furniture, etc., caused by storms, collisions, or fire at light stations, depots, and on vessels. Legislation is also needed to give corresponding employees of the Lighthouse Service certain necessary privileges now accorded by law to similar services, including the purchase of commissary supplies, transportation of families and of household effects when ordered to permanently change station, and transportation on Army transports.

PROTECTION OF AIDS TO NAVIGATION.

Legislation is needed for the better protection of aids to navigation. Such aids, especially those located in the water, are often damaged by passing vessels, and it is difficult in many instances to locate the party at fault. More stringent requirements are necessary as to failure to report such injuries, etc. Sums received in payment should also be made available for repair of aids.

MILITARY STATUS OF OFFICERS AND EMPLOYEES TRANSFERRED TO THE NAVY OR WAR DEPARTMENTS IN A NATIONAL EMERGENCY.

All persons so transferred should have a suitable military status and be entitled to all relief provided by legislation for those in the military services. A statement on this subject is given on pages 30 and 31, report for 1919.

AIDS TO NAVIGATION.

During the fiscal year ended June 30, 1920, there was a net increase of 256 in the total number of aids to navigation maintained by the Lighthouse Service. There was an increase of 68 lights, 28 gas buoys, 7 float lights, and 165 unlighted aids.

On June 30, 1920, there were maintained by the Lighthouse Service 16,324 aids to navigation, including 5,754 lights of all classes and 584 fog signals (not including 153 buoys with whistles and 369 buoys with bells), of which 48 are submarine signals.

The table following gives a summary of the aids to navigation, under each class, established and discontinued during the fiscal year,

and also the net increase, and the number in commission at the end of the fiscal years 1919 and 1920:

Class.	1920			Total, June 30—	
	Estab- lished.	Discon- tinued.	Increase.	1919 ¹	1920
Lighted aids					
Lights (other than minor lights).....	82	14	68	1,768	1,836
Minor lights.....	125	136	11	3,129	3,118
Light-vessel stations.....		1	1	50	49
Gas buoys.....	60	32	28	554	582
Float lights.....	19	12	7	162	169
Total.....	286	195	91	5,663	5,754
Unlighted aids:					
Fog signals.....	5	3	2	534	536
Submarine signals.....		1	1	49	48
Whistling buoys, unlighted.....	2	3	1	79	78
Bell buoys, unlighted.....	5	7	2	245	243
Other buoys.....	328	183	145	7,050	7,195
Day beacons.....	62	40	22	2,448	2,470
Total.....	402	237	165	10,405	10,570
Grand total.....	688	432	256	16,068	16,324

¹ Differences from statistics published in 1919 report are due to minor discrepancies in previous count.

² Decrease.

Improvements in aids to navigation in the Service generally have been made during the year, as follows: Forty-four fixed lights were changed to flashing or occulting (including 4 light vessels); the illuminant of 3 lights was changed to incandescent oil vapor; the illuminant of 47 lights (including 4 light vessels) was changed to acetylene; the illuminant of 13 lights was changed to electric incandescent.

Fog signals were established at five important stations and the fog signals at five important stations were improved by the installation of air diaphones, etc., in place of less efficient apparatus. Work was continued during the year in repairing damage to aids to navigation caused by ice during the winter of 1917-18, especially to screw-pile structures in Chesapeake Bay and Potomac River. The work of repairing hurricane damage to aids in the Gulf of Mexico was also vigorously prosecuted during the year.

General repairs required for upkeep of aids to navigation in efficient working condition were continued during the year so far as available funds permitted, but the funds available were far from sufficient for the proper upkeep of this large amount of public property.

Damage to lighthouse property, estimated at \$245,000, was sustained in the seventh and eighth districts by hurricane of September 8-16, 1919. The act of March 6, 1920, appropriated \$125,000 for repairing this damage.

The severe storm which prevailed along the Middle and North Atlantic coasts early in February, 1920, resulted in considerable damage to lighthouse property and caused two light vessels to break from their moorings.

The act of June 5, 1920, authorized the establishment of post lights and other aids to navigation on the Yukon River and its tributaries.

Various special works were actively carried on during the year, including the establishment of important light and fog-signal stations and lighthouse depots, improvements in systems of fixed aids and buoyage, etc.

ALASKA.

During the year 69 new aids were established in Alaska. Seventeen new lights were established; 5 lights were changed from fixed to flashing; 3 gas and bell buoys were established; also 17 unlighted buoys and 32 beacons.

The total number of aids to navigation in Alaska, including lights, gas buoys, fog signals, buoys and daymarks, in commission at the close of the fiscal year ended June 30, 1920, was 535, including 196 lights and 10 gas buoys, representing an increase of 169 lighted aids since June 30, 1910, or 457 per cent. The following table, which gives the total number of aids to navigation on June 30 of 1910, 1915, and of each succeeding year, illustrates the progress in establishing aids in the Territory:

Aids.	1910	1915	1916	1917	1918	1919	1920
Lights.....	37	112	147	152	161	180	196
Gas buoys.....				7	7	8	10
Fog signals.....	9	10	11	11	11	11	11
Submarine bell.....				1	1	1	
Buoys.....	84	167	181	189	198	211	224
Daymarks.....	30	49	49	56	61	64	94
Total.....	160	338	388	416	439	475	535

A lighthouse depot for the Alaska district has been partially built at Ketchikan, in a desirable location with respect to that city. While the funds available will not permit of its completion, the storehouse and wharf were put in service just after the close of the fiscal year, and the use of these improved depot facilities will greatly facilitate the work of the Lighthouse Service in Alaska.

The estimates include a light and fog-signal station at Cape Spencer, an item of \$125,000 for new aids and improvements in Alaska, and an item for the completion of the depot at Ketchikan. Investigation indicates the need of additional fog signals at critical points, as well as other aids to navigation.

GUANTANAMO, SAMOA, AND GUAM.

The act of July 1, 1918, appropriated \$14,000 for dwellings for keepers and improvements at Guantanamo Bay, Cuba. A double dwelling has been constructed, and materials and equipment purchased for improvements of two sets of range lights.

The aids to navigation in the outlying United States territory at Guantanamo Bay, the American Samoan Islands, and the island of Guam are maintained under the supervision of the naval commanders by means of allotments made from the appropriations for the Lighthouse Service. Reports have been received from naval officers in local charge indicating that the aids have been properly maintained at an approximate annual expense as follows: Guantanamo, \$4,472; Samoa, \$931; Guam, \$1,000.

VESSELS, URGENT NEED FOR REPLACEMENT.

As explained in detail in the last annual report, there is very urgent need for the construction of additional vessels for the Lighthouse Service, to replace those worn out in service, those lost through

various casualties, and to meet the considerable growth of the Service. The total number of vessels available for this Service is now actually less than it was 10 years ago, although the number of aids to navigation maintained has increased 39 per cent in this period. The act of June 5, 1920, authorized a building program for vessels to the amount of \$5,000,000, but no funds were appropriated.

Full details as to the conditions and requirements with respect to vessels are given in the report for 1919, pages 8 to 13 (also Report of the Secretary of Commerce, 1919, Appendix A), and the statements therein hold good at present, excepting that the average age of the present vessels has increased by one year, and that appropriations were made for the three vessels for which estimates had previously been submitted, and not included in the building program of 17 vessels. Further details as to tenders and light vessels of this Service are given under these heads, respectively.

ADMINISTRATION.

The general organization of the Service remained unchanged during the fiscal year.

The appropriations for the maintenance of the Lighthouse Service for the fiscal year 1921 were \$547,378 less than the estimates submitted, and additional funds will be necessary for even the minimum maintenance of the Service during this fiscal year; for this deficiency estimates will be submitted.

The pay question is a very serious one throughout the Lighthouse Service. The bonus increases made by Congress have proved inadequate to meet the difficulty, and consequently do not satisfy the personnel. This bonus averages about 10 per cent to 15 per cent over prewar salaries, which is very much less than the well-authenticated figures as to the increased cost of living during the same period. Discontent is increased by the fact that in certain classes of occupation, both without and within the Government service, increases of compensation have been made, equaling or exceeding the increased cost of living, and that in the organization of new Government activities much higher scales of compensation have been set. Within the Lighthouse Service itself serious inequalities have arisen through the inability to extend throughout the Service the same proportionate increase made in certain occupations because of the action of outside Government boards. Serious discrepancies result, which the estimates submitted will endeavor to correct. The complaints of the actual difficulty of living decently and supporting a family on the present compensation in some grades are known to be well founded. Such adjustments as possible to meet the situation have been made.

Much difficulty has been had in maintaining sufficient and efficient complements on vessels of the Lighthouse Service, notwithstanding increases of pay scales. Great credit is due to many of the officers of these vessels for their loyal work and standing by the Service under these difficult conditions.

The retirement act of May 22, 1920, which provides a system of general retirement for the civil employees of the Government, going into effect August 21, 1920, will be of much benefit to those employees of the Lighthouse Service who were not covered by the retirement law of June 20, 1918, providing retirement for certain classes of employees in this Service.

The regulations for lighting bridges and the regulations for uniforms were revised. Light keepers and depot keepers were authorized to wear sleeve insignia to indicate length of service in the Lighthouse Service.

Systematic inspections have been continued in the various lighthouse districts of the technical work, business methods, and property accounts. A case occurred of misappropriation of public funds involving one of the bonded special disbursing agents, who was promptly apprehended, and whose case is now in the hands of the Department of Justice for prosecution.

The Navy Department granted permission for vessels of the Lighthouse Service located in districts contiguous to navy yards and other naval stations, to obtain provisions from the Navy commissary, reimbursement for the provisions furnished to be effected by transfer of lighthouse appropriations. This arrangement will be of much benefit to the messes of vessels of the Lighthouse Service.

ENGINEERING AND CONSTRUCTION.

The more important items of construction completed during the fiscal year were the improvement of lighting of Ambrose Channel into New York Harbor by use of modern acetylene buoys; final completion of the lighting of the new Chester and Marcus Hook dredged channels in the Delaware River by means of ranges; establishment of an unattended light and fog signal on a caisson structure on Cherrystone Bar, near Cape Charles City, Va.; the final completion of Galveston Jetty light and fog-signal station, Tex., by installation of mechanically operated fog bell; establishment of a light on steel tower on the west pier at Huron Harbor, Ohio, and the construction of a light and fog-signal station at outer end of the North Breakwater, Manitowoc, Wis., and also a switch house at shore end of breakwater from which the light and fog signal are electrically controlled.

Other important works in progress at the close of the fiscal year included the following: New lighthouse depot at Chelsea, Mass.; aids to navigation, Hudson River, N. Y.; improvement of wharves and construction of new buildings, Staten Island Depot, N. Y.; riprap protection for light stations in the third district; improvement of aids to navigation, East River, N. Y.; aids for eastern shore of Chesapeake Bay; repairing and rebuilding aids on Atlantic and Gulf coasts damaged by storms; improvement of aids, St. Johns River, Fla.; aids for Mississippi River below New Orleans, La.; new structures for Point Borinquen and Point Jiguero Light Stations; aids, Guantanamo Bay, Cuba; new light and fog-signal stations at Conneaut, and Fairport Harbors, Ohio; aids to navigation, Keweenaw Waterway and St. Marys River, Mich.; repairs to Spectacle Reef Light Station and improvements at the lighthouse depot, Detroit, Mich.; moving and rebuilding Chicago Harbor Light Station, Ill.; construction of new light and fog-signal station, Indiana Harbor, Ind.; new lighthouse depot at Ketchikan, Alaska; establishing and improving numerous aids in Alaska; improvements in aids to navigation, Washington and Oregon; new light and fog-signal station at Point Vicente, Calif.; and a new system of aids for Pearl Harbor, Hawaii. These works are described on pages 43 to 54.

IMPROVEMENT OF APPARATUS AND EQUIPMENT.

In cooperation with the Bureau of Standards tests were made for the purpose of determining the efficiency of radio fog signals automatically sent from light stations and light vessels and a radio compass on a vessel, to enable bearings to be taken of the fog-signal stations from the vessel. Installations were made at three light stations in Chesapeake Bay, and an improved type of radio compass was experimentally installed on a lighthouse tender. Further experiments with improved apparatus are now in progress and give excellent promise of the success of this probably great advance in fog-signal engineering.

Radio equipment was installed on 3 light vessels and on 4 tenders during the fiscal year. At the end of the fiscal year 42 light vessels and 27 tenders in all had been equipped with radio apparatus.

Improvement of intercoastal communication by the installation of telephones at light stations was continued during the year by the Coast Guard. On June 30, 1920, 274 light stations had telephone connections.

Experiments and tests continued during the year with various devices and equipment used in lighthouse work have resulted in developing improvements in the interest of efficiency and economy in the Service. A new type of winch for hoisting and lowering boats at light stations, to replace the old type of winch which has been the source of numerous casualties, has been developed and installed at some light stations.

The automatic aerial fog bell, having a striking mechanism operated by compressed carbon-dioxide gas, has been continued in service during the fiscal year on a buoy in the fifth lighthouse district, replacing the former Bush Bluff Light Vessel, and has been sufficiently satisfactory to warrant a second installation, which has been placed on an unwatched fixed structure making the approach to Cape Charles City, Va.

A 6,000-pound mercury float and pedestal, probably the largest constructed in this country, was installed at Cape Fear Light Station, N. C., replacing the worn-out lens chariot in use since the station was established in 1903.

A concrete muffler was installed at Boston Light Station, Mass., which effectively reduces the noise of the engine exhaust so that it is audible only a short distance.

Experiments recently completed with a new type, small upright oil-gas mantle indicate that this type is as efficient as the old type, consumes less gas, and is more easily installed and handled.

A light, tall type, metal cone buoy, designed to replace wooden buoys which were subject to damage by ice, etc., has been developed for use in shoal water channels, and has proven efficient.

PERSONNEL.

On June 30, 1920, there were 6,002 persons employed in the Lighthouse Service, including 124 technical, 158 clerical, and 5,720 employees connected with light stations, vessels, and depots. This Service is charged with the maintenance of aids to navigation along 49,012 statute miles of general coast line and river channel, including 1,712 miles of the Yukon River and its tributaries.

The following table gives the number of employees (all authorized employees, including some vacancies) of the Lighthouse Service at the end of the fiscal year and a comparison of the totals with those for the previous fiscal year:

EMPLOYEES IN THE LIGHTHOUSE SERVICE ON JUNE 30, 1920.

District.	Superintendents, engineering force, draftsmen, aids, appointed foremen, and mechanics.	Clerks, messengers, janitors, and office laborers.	Depot keepers and assistants, including laborers.	Light keepers and assistants.	Laborers and laborers in charge of lights (appropriation "Sa'aries, keepers of light houses").	Laborers in charge of post lights and buoys (appropriation "General expenses").	Custodians of reservations.	Officers and crews on tenders and light vessels.	Field force for construction and repair (registered).	Field force for construction and repair (unregistered).	Total.
Bureau.....	17	27									44
First.....	3	6	1	115	3			74	10	7	219
Second.....	4	7	2	79	11		2	238	7	10	360
Third.....	21	34	10	188	31	44	12	293	182	45	850
Fourth.....	6	5	3	52	3	4	8	33	6	7	127
Fifth.....	8	11	11	163	100	10		290	14	3	653
Sixth.....	4	7	2	55	10	25		143	14	3	293
Seventh.....	2	3	1	41	1	7		39	5	16	115
Eighth.....	5	9	13	113	31	40		110	13	19	365
Ninth.....	3	5		40	7	1		25	5	10	96
Tenth.....	8	5	2	69	1		1	28	6	17	137
Eleventh.....	9	6	6	155	8	2	2	114	15	23	349
Twelfth.....	9	7	5	156	17	2		99	8	6	309
Thirteenth.....	1	2				319		19			341
Fourteenth.....	1	2				537		14			554
Fifteenth.....	1	2				344		21			368
Sixteenth.....	5	5	1	33		19		54		18	145
Seventeenth.....	5	6	5	79	16	124		131	5	2	373
Eighteenth.....	6	6	7	106	13	6		96	3	10	263
Nineteenth.....	4	3	1	27	2			31		12	80
Total, 1910.....	124	158	103	1,471	254	1,504	15	1,862	193	118	6,602
Total, 1919.....	128	156	114	1,477	254	1,513	13	1,802	165	215	5,967
Increase.....		2					2	60	28		35
Decrease.....	4		11	4		9				17	

During the fiscal year services in saving life and property were rendered and acts of heroism performed by employees of the Lighthouse Service on 129 occasions. Many of these acts were especially meritorious and the employees were individually commended by the Secretary of the Department.

COST-KEEPING SYSTEM AND RESULTS.

A cost-keeping system has been continued in effect throughout the fiscal year.

The costs are based on the actual expenditures during the fiscal year, whether of money or supplies. The information from this cost-keeping system is useful in furnishing information as to the disposition of all appropriations for this Service, in preparing estimates, planning work, effecting economies, and comparing the efficiency of different districts, vessels, light stations, apparatus, methods, etc.

A generalized summary of costs for the fiscal year ended June 30, 1920, follows, as derived from this cost-keeping system. Notwithstanding the most careful and painstaking efforts to economize in every direction, and making allowance for increased expenditures due to the material growth of the service from year to year, the continued advance in the price of labor and materials is clearly shown in the increased costs reported for practically all features.

SUMMARY OF COSTS, LIGHTHOUSE SERVICE, FISCAL YEAR ENDED JUNE 30, 1920.

[Amounts are stated to nearest even dollar, causing occasional minor discrepancies in totals. Difference from total expenditures reported elsewhere is due to inclusion of Bureau salaries, printing expenses, and adjustment of inventories of articles furnished from stock.]

TOTAL COSTS OF PRINCIPAL FEATURES.

Feature.	Maintenance expenses.				Total.	Betterment expenses.				Grand total.	Per cent.	
	Salaries.	Subsistence.	General supplies.	Incidental expenses.		Repairs and improvements.			New works.			Total.
						Hired labor.	Materials.	Contract work.				
Administration 1.....	\$383,654	\$35,821	\$28,832	\$7,299	\$455,606					\$455,606	5	
Distributive charges 2.....	1,663,756	325,907	853,388	64,208	2,907,259	\$112,000	\$136,845	\$409,408	\$242,198	\$900,451	40	
Aids to navigation 3.....	2,572,494	366,970	893,260	14,190	3,846,923	202,878	271,498	200,797	679,817	1,354,990	55	
Total.....	4,619,904	728,698	1,775,480	85,706	7,209,788	314,878	408,343	610,205	922,015	2,255,441	100	

TOTAL COSTS OF DETAILED FEATURES.

Offices.....	\$383,654	\$35,821	\$40,844	\$7,299	\$467,618	\$50,227	\$40,203	\$15,346	\$223,261	\$329,127	\$467,618	5
Depots.....	272,711		174,723	40,993	488,427						817,554	9
Tenders:												
Large.....	389,683	93,021	233,265	6,966	722,935	17,003	19,687	37,563		74,253	797,188	8
Medium.....	894,017	208,702	397,168	14,361	1,514,248	38,131	61,579	321,112	18,285	442,107	1,956,355	21
Small.....	107,345	24,184	36,220	1,888	169,637	6,639	12,286	35,387	652	54,904	224,601	2
Total.....	1,391,045	325,907	666,653	23,215	2,406,820	61,773	96,552	394,062	18,937	571,324	2,978,144	31
Light vessels:												
Exposed.....	313,300	56,630	92,083	1,755	463,768	10,312	12,048	68,410		90,770	554,538	6
Moderately exposed.....	199,446	36,114	39,508	340	275,466	5,319	11,072	17,018	912	34,321	309,787	3
Relief.....	102,417	19,885	29,493	529	152,324	3,845	7,639	9,464		20,918	178,272	2
Lakes.....	88,194	18,669	15,632	455	122,950	1,859	4,832	4,261	102,400	113,352	236,302	2.5
Total.....	703,357	131,298	176,774	3,079	1,014,508	21,335	35,591	99,153	103,312	259,391	1,273,899	13.5

Light stations: Primary seacoast and lake lights. All other lights except post lights. Post lights. Day marks and spindles.	450,634	71,408	122,870	4,100	649,012	40,905	50,614	50,878	73,373	215,770	864,782	9
	1,128,216	164,264	277,537	4,309	1,574,326	108,412	149,900	41,372	470,669	770,353	2,344,679	25
	257,276		34,401	2,217	293,894	4,744	15,584	4,185	5,084	29,597	323,491	3.5
			948	494	1,440	1,695	1,771	1,125	1,036	5,627	7,069	
Total.	1,836,126	235,672	435,756	11,120	2,518,674	155,756	217,869	97,560	550,162	1,021,347	3,540,021	37.5
Buoys.	33,011		280,730		313,741	25,789	18,038	4,084	26,343	74,254	387,995	4
Grand total.	4,619,904	728,698	1,775,480	85,706	7,209,788	314,878	408,343	610,205	922,015	2,255,441	9,405,229	100

AVERAGE COST OF SELECTED FEATURES.

Average cost of—	Salaries.	Subst- ence.	General supplies.	Incidental expenses.	Total mainte- nance.	Repairs and im- provements.	Total cost.
District office, exclusive of third.	\$14,847	\$439	\$447	\$285	\$16,018		\$16,018
District depot, exclusive of third.	4,547		1,512	475	6,534	\$1,727	8,261
Large tender, Pacific.	39,113	9,751	27,815	626	77,305	8,074	85,378
Large tender, Atlantic.	38,872	9,003	20,334	744	68,953	6,993	75,946
Medium tender.	28,214	6,521	12,313	443	47,491	13,712	61,203
Exposed light vessel.	15,665	2,832	4,604	88	23,189	4,538	27,727
Moderately exposed light vessel.	10,497	1,901	2,082	18	14,498	1,758	16,256
Lake light vessel.	6,784	1,436	1,202	35	9,458	842	10,300
Primary seacoast light station.	3,045	482	1,830	25	4,385	962	5,347
Other light station (except post lights).	512	75	126	2	715	136	851
Post light, river district.	95		7	1	103		103
Post light, other district.	105		26	1	132	30	162

¹ Includes offices, except expenses of publications.
² Includes depots and tenders; also item excepted above, charged to supplies.
³ Includes light vessels, light stations, minor fixed aids, and buoys.
NOTE.—The above average costs for district depots are not comparable with those published for previous years, as all minor depots are here included in the averages, which has not been done heretofore.

APPROPRIATIONS AND EXPENDITURES.

The appropriations for the maintenance of the Lighthouse Service for the fiscal year 1921 were \$7,837,290, being \$248,860 in excess of those for the preceding fiscal year. These appropriations were \$547,378.40 less than the estimates submitted.

Appropriations for special works aggregating \$1,366,600 were made in deficiency appropriation bills during the fiscal year 1920, but no appropriations for special works were made in connection with the general maintenance appropriations for the fiscal year 1921 in the sundry civil bill of June 5, 1920.

The average appropriations for special works for the 10 preceding years, 1911 to 1920, inclusive, amounted to \$785,835.

The detailed estimates for the fiscal year 1922 are given on pages 67 to 79. The total amount for general maintenance is \$1,717,250 more than the appropriation for the present year. Particular attention is again invited to the urgent need of the Lighthouse Service for additional funds. The increase in the cost of all materials has continued, salaries and wages have been or must be advanced, and in order that the Service may be maintained at a proper standard of efficiency a corresponding increase in its appropriations is necessary. The Bureau desires to lay special stress on this matter, and on page 7 includes a more detailed statement with reference to pay.

Increases are urgently needed in the pay scale of the Bureau of Lighthouses in Washington, and it is recommended that this general subject be considered and favorably acted on by Congress in accordance with the report submitted by the Joint Commission on the Reclassification of Salaries.

Estimates for 28 special works have been submitted, aggregating \$7,875,250, considering only group 1, of which items amounting to \$6,235,000 are authorized by law. As no appropriation was made for special works for 1921, this estimate includes a number of important works for which estimates were submitted last year, but which were not appropriated for. The estimates include 5 new lighthouse tenders, 13 new light vessels, 6 new lighthouse depots, or the completion of new depots, 6 items for establishing or improving aids in general localities, 5 items for improvements of harbor or channel lights and other aids, 3 items for establishing or completing light and fog-signal stations, and 6 items for improvement of lighthouse depots.

In selecting and submitting estimates for these special works, believed to be most important, there were considered estimates submitted by officers in the various districts and others for new lighthouse and ship construction aggregating about \$10,475,000, which amount, however, did not include most of the urgently needed vessel-rebuilding program. Many items not included in the estimates for this year are thought to be meritorious, and the more important of them are included in group 2 of the estimates for special works, submitted for consideration as the resources of the Government permit them to be taken up. Explanation of the necessity for each of the items of special works is included with the estimates.

The tables following give comparisons of appropriations and expenditures for the Lighthouse Service, beginning with the fiscal year 1917 and including the estimates for 1922.

APPROPRIATIONS, LIGHTHOUSE SERVICE, FISCAL YEARS 1917-1921, WITH ESTIMATES FOR 1922.

[The salaries and allowances of officers of the Army on duty with the Lighthouse Service are not included in this table.]

Item.	Appropriations.					Estimates.
	1917	1918	1919	1920	1921	1922
MAINTENANCE.						
Salaries, Bureau of Lighthouses.....	\$64,030	\$64,030	\$65,430	\$65,430	\$67,200	\$89,540
General expenses, Lighthouse Service	2,790,000	2,850,000	3,500,000	4,030,000	4,200,000	5,100,000
Salaries of keepers of lighthouses.....	940,000	940,000	1,184,432	1,300,000	1,300,000	1,590,000
Salaries, lighthouse vessels.....	1,070,000	1,104,650	1,265,000	1,775,000	1,800,000	2,175,000
Salaries, Lighthouse Service.....	375,000	380,000	380,000	383,000	400,000	500,000
Retired pay, Lighthouse Service.....			30,000	65,000	70,000	100,000
Total for maintenance.....	5,239,030	5,338,680	6,434,862	7,588,430	7,837,200	9,554,540
Unexpended balances (obligations estimated).....	67,377	14,100	66,283	35,775		
SPECIAL WORK.						
New light and fog-signal stations....	193,000	155,000	80,000	26,000		497,500
Light vessels.....		280,000		450,000		3,700,000
Lighthouse tenders.....	20,000	210,000		760,000		1,300,000
Keepers' dwellings.....				50,000		
Improvement of aids.....	736,000	613,000	795,000	300,000		894,000
Lighthouse depots.....	50,000	21,000	288,000	42,000		1,485,750
Total for special works.....	999,000	1,279,000	1,163,000	1,721,000		7,875,250
Total maintenance and special works.....	6,238,030	6,617,680	7,597,862	9,309,430	7,837,200	17,429,790

EXPENDITURES FROM APPROPRIATIONS, LIGHTHOUSE SERVICE, FISCAL YEARS 1916-1920.

[Actual expenditures, regardless of year of appropriation.]

Expenditures.	1916	1917	1918	1919	1920
For maintenance.....	\$5,002,706.25	\$5,220,473.07	\$6,246,088.83	\$6,694,537.90	\$8,583,202.14
For special works.....	748,833.50	651,298.99	499,633.24	880,958.40	1,004,501.28
Total.....	5,751,539.75	5,871,772.06	6,745,722.07	7,575,496.30	9,587,703.40

Financial benefits not included in the above statement were received by the Lighthouse Service from the following sources:

During the fiscal year 1920 employees of the Lighthouse Service were paid a total of \$844,319 from the appropriation increase of compensation, Department of Commerce, in addition to salaries paid from Lighthouse appropriations.

Medical treatment by the Public Health Service, without charge, was received by approximately 834 employees of the Lighthouse Service during the fiscal year for an aggregate of approximately 5,571 days.

Compensation for injuries under the employees' compensation law was received by some employees of the Lighthouse Service.

LIGHTHOUSE DEPOTS.

A lighthouse depot, very much needed for the Alaska district, has been partially built at Ketchikan, Alaska, under appropriations of \$90,000 and \$12,000. While the wharf and storehouse were put in use just after the end of the fiscal year, the funds are not sufficient to complete the depot.

Work on the construction of a new lighthouse depot at Chelsea, Mass., for the second lighthouse district, under an appropriation of \$85,000 made by act of July 1, 1918, was in progress, but the amount will be insufficient to complete the depot.

Important improvements are in progress at the General Lighthouse Depot, Tompkinsville, N. Y. Under the appropriation of March 28, 1918, of \$60,000 for repairs to wharves, portions of the old wooden wharves are being replaced by concrete decks with cast-iron pile columns.

Under the allotment of \$175,000 in August, 1918, from funds for national security and defense, a new plate and boiler shop has been built at this depot, and new concrete coal bins are being constructed. It is expected to complete this project in November, 1920.

The act of June 20, 1918, authorized \$275,000 for improvements at the lighthouse depot at Portsmouth, Va., or establishing a new depot, but no appropriation has been made for this work. This is the principal depot of one of the largest lighthouse districts and is the headquarters for five tenders and two light vessels during the greater part of the year. The facilities for berthing these vessels are entirely inadequate and the efficient operation of the vessels is much hampered in consequence. The inadequacy of space for storing and handling buoys also causes much delay and loss. Increased facilities for this depot are urgently necessary.

The act of June 5, 1920, authorized \$250,000 for a new lighthouse depot at Key West, Fla., \$120,000 for a depot at Honolulu, Hawaii, \$16,500 for improvements at Goat Island Lighthouse Depot, San Francisco, Calif., and \$60,000 for improvements at the Charleston, S. C., Lighthouse Depot, but no appropriations have been made for these works.

LIGHTHOUSE TENDERS.

The tenders of the Service have been employed to good advantage during the year. The 55 vessels which have been in commission have steamed a total of about 465,000 nautical miles in their work of supplying light vessels and light stations, maintaining the buoyage system, transporting construction materials, and carrying the officers and employees of the Service to their stations or on inspection duty, in addition to work performed in cooperation with other Government departments.

The tenders have been able to render good service under difficulties, considering the fact that they have in many cases been operated with short crews and inexperienced men, caused by labor conditions and the scarcity of skilled seamen due to inadequate funds to meet the wages paid elsewhere.

An appropriation of \$20,000 was made by the act of July 1, 1916, for a light draft tender and barge for use in establishing aids along the intercoastal waterways of Texas and Louisiana. Proposals have

been invited three times for a small tender only, with the expectation that a sufficient balance would remain for the construction of a suitable barge. All bids received exceeded the appropriation and were rejected. The specifications are now being modified and bids will again be invited in the near future.

With the increase in the number of aids to navigation and the deterioration of older vessels, it will be necessary to construct on an average of at least two tenders each year, and also make good the deficiency in construction of recent years. A full statement as to the need of new vessels was given on pages 11, 12, and 13 of the Annual Report for the fiscal year 1919. (See also p. 12 of this Report.)

The act of November 4, 1919, appropriated \$760,000 for the construction of tenders and light vessels. Plans and specifications were prepared, and on receipt of bids it was found that only two vessels could be built with the amount appropriated, and contracts were accordingly awarded for two tenders, the *Oak* and *Hawthorn*, which are most urgently needed to replace the tenders *Gardenia* and *Jessamine*.

The act of June 12, 1917, appropriated \$150,000 to replace the tender *Gardenia*, which has been condemned and sold, being of no further use to the Service. Bids received were greatly in excess of the appropriation and were rejected. It is now proposed to use this appropriation for the construction of a smaller tender for general service.

The act of June 5, 1920, authorized \$5,000,000 for—

Constructing or purchasing and equipping lighthouse tenders and light vessels, provided that the Secretary of War, the Secretary of Navy, and the Shipping Board shall report to the Secretary of Commerce such vessels as they are willing to dispose of and which by reasonable alterations can be used for light vessels, or lighthouse tenders; and if the use of the vessels should be justified by the necessary expenditure for alterations, transfer of the ships shall be made to the Department of Commerce, and they shall be used for the purposes of this Act; and the sum herein authorized shall be available for such repairs and be reduced by the sums saved by the use of such vessels.

No appropriation has yet been made. In anticipation that an appropriation will be made by Congress during the next term, specific data covering the type of vessels required by this Service to meet its needs, has been submitted to the War and Navy Departments and the Shipping Board for the purpose of ascertaining if any suitable vessels are available for transfer.

Plans and specifications for new light vessels and tenders are also in preparation upon which bids will be invited in the event that no suitable vessels are available for transfer, as at least 17 vessels are urgently needed to replace those now in service which are nearly worn out.

Some of the smaller vessels no longer required by the Navy and the War Departments were examined by representatives of the Bureau with a view to the transfer to the Lighthouse Service of such as were suitable for lighthouse purposes. The 106-foot converted freight boat *E. Mansfield and Sons Co.*, constructed of wood and steam propelled, was accordingly transferred to the Lighthouse Service on October 28, 1919, for use as a small tender, and was renamed *Shrub*. Five 30-foot stevedoring barges complete with double hoisting engines and boilers were transferred by the Navy to the Lighthouse

Service during August and September, 1920. It is proposed to convert them for use as pile drivers and for other purposes. Two 115-foot barge lighters were purchased from the War Department at a cost of \$4,500 each and transferred to the Lighthouse Service on June 8, 1920. It is proposed to use them for transporting and placing riprap and other construction material for use at light stations.

The following tenders have either been extensively overhauled or such work has been started during the fiscal year 1920: *Amaranth*, *Columbine*, *Cedar*, *Camellia*, *Fern*, *Hyacinth*, *Hibiscus*, *Iris*, *Juniper*, *Maple*, *Marigold*, *Mangrove*, *Shrub*, *Zizania*.

It is probable that during the current year extensive overhaul will be completed or undertaken on the following tenders: *Arbutus*, *Aspen*, *Azalea*, *Clover*, *Crocus*, *Cypress*, *Dandelion*, *Fern*, *Ivy*, *Jessamine*, *Madrona*, *Magnolia*, *Manzanita*, *Mayflower*, *Oleander*, *Poinsettia*, and *Snowdrop*.

The following was the number of tenders of the Lighthouse Service on June 30 of the years specified, omitting vessels not having regular crews and those less than 50 feet in length: 1910, 51; 1911, 46; 1912, 45; 1913, 44; 1914, 45; 1915, 46; 1916, 47; 1917, 51; 1918, 51; 1919, 55; 1920, 55. On June 30, 1920, the following was the status of the tenders: In actual service, 47; undergoing repairs, 8.

LIGHT VESSELS.

The Lighthouse Service maintains light vessels on 49 stations and has for this purpose 62 light vessels, of which 12 are relief vessels. Some of these vessels are old, 3 having been built over 50 years ago; 8 having been built over 60 years ago; 1 is 71 years old. Some of the older vessels are in a condition which does not warrant extensive repairs.

Bush Bluff Light Vessel No. 97, formerly the Coast and Geodetic Survey schooner *Drift*, and Thirty-Five Foot Channel Light Vessel No. 45 were surveyed, condemned, and recommended for sale in 1918. As no bids were received for these vessels separately it was considered more advantageous to combine the sale. This was done on April 27, 1920. Light vessel No. 45 was sold for \$2,113, and light vessel No. 97, for \$150.

Relief light vessel No. 43 was surveyed, condemned, and recommended for sale on March 4, 1920, after a thorough examination had been made; it being found that the vessel was beyond economical repair and of no further use to the Lighthouse Service. The vessel sold for \$5,300 on June 17, 1920.

A complete statement of vessels sold during the fiscal year will be found on page 40. In this connection attention is invited to the nominal amounts received for these vessels which indicates their extremely poor and worn out condition.

Bar Point Shoal Light Vessel No. 62, Detroit River, was maintained on the station until the close of navigation for 1919, and was then permanently withdrawn, the Canadian Government having agreed to establish a light vessel on the station, which is located in Canadian waters.

The act of November 4, 1919, appropriated \$450,000 for the construction of a light vessel for Diamond Shoal Light Vessel Station, N. C., to replace light vessel No. 71 which was sunk by a German

submarine on August 6, 1918. The station is at present marked by light vessel No. 72, which was a relief vessel.

The act of June 12, 1917, appropriated \$130,000 for a light vessel for Cape Charles, Va., or for general service, plans and specifications were completed, and bids invited for the construction of the vessel. The lowest bid received was greatly in excess of the appropriation. No expenditures were made from this appropriation to June 20, 1920. It is proposed to construct a smaller light vessel for general service with this appropriation.

During the fiscal year 62 light vessels were in commission. New vessels under construction are light vessels No. 99 and No. 103, of the third class, for duty on the Great Lakes, and a first-class light vessel, No. 105, for Diamond Shoal Light Vessel Station, N. C.

The following light vessels have either been extensively overhauled or such work has been started during the last fiscal year: No. 1, No. 13, No. 23, No. 53, No. 66, No. 84, No. 88, No. 92.

It is probable that during the current fiscal year extensive overhaul will be completed or undertaken on the following light vessels: No. 41, No. 46, No. 47, No. 52, No. 67, No. 74, No. 76, No. 78, No. 79, No. 80, No. 81, No. 83, No. 85, No. 94.

The following was the total number of light vessels and stations on June 30 of the years named:

Year.	Light vessels.	Light- vessel stations.	Year.	Light vessels.	Light- vessel stations.
1910.....	68	54	1916.....	66	53
1911.....	63	51	1917.....	68	53
1912.....	65	51	1918.....	67	52
1913.....	67	53	1919.....	65	50
1914.....	66	52	1920.....	62	49
1915.....	66	53			

Of the present light vessels, 36 have self-propelling machinery and 25 are provided with only sail power. One has no means of propulsion.

On June 30, 1920, the following was the status of the light vessels: Regular vessels on station, 42; relief vessels on station, 6; relief vessels at depots, 5; regular vessels under repair, 7; relief vessels under repair, 1; regular vessels laid up, 1; relief vessels laid up, 0.

REPORT OF OPEN-MARKET PURCHASES.

In compliance with the act of June 17, 1910, there is submitted separately as a part of this report a list of purchases of materials and supplies for the Lighthouse Service made without obtaining bids under public advertisement, with the reasons for so purchasing.

LEGISLATION ENACTED AFFECTING THE LIGHTHOUSE SERVICE.

The deficiency act of November 4, 1919, appropriated the following amounts for the purposes stated:

Constructing or purchasing and equipping lighthouse tenders and light vessels to replace vessels worn out in service in the third, fifth, and eighth districts, or for use in the Lighthouse Service generally.....	\$760, 000
Constructing and equipping a light vessel for station off Diamond Shoal, N. C., or for general service.....	450, 000
Completing the light and fog-signal station at Conneaut, Ohio.....	19, 600

The deficiency act of March 6, 1920, appropriated the following amounts for the purposes stated:

Depot for the sixteenth lighthouse district.....	\$12, 000
Repairing and rebuilding aids to navigation, seventh and eighth lighthouse districts.....	125, 000

The act of June 5, 1920, authorized the following works, but (except item of \$12,000 for continuing construction of lighthouse depot for sixteenth district, Alaska, which was contained in deficiency act of Mar. 6, 1920), no appropriation of funds was made therefor:

New vessels for general service.....	\$5, 000, 000
Extending and enlarging the machine shop, General Lighthouse Depot, Tompkinsville, N. Y.....	15, 000
Riprap for protection of light stations, third district.....	134, 000
Aids to navigation, Delaware Bay.....	148, 500
Completing the lighthouse depot at Charleston, S. C.....	60, 000
Aids to navigation, Tampa Bay, Fla.....	17, 500
Purchasing site and constructing and equipping a lighthouse depot for the seventh district.....	250, 000
Improving Galveston Jetty Light Station, Tex.....	6, 500
Aids to navigation, Ludington, Mich.....	50, 000
Aids to navigation in Alaska.....	32, 500
Continuing construction of lighthouse depot for sixteenth district, Alaska..	12, 000
Aids to navigation, California.....	25, 000
Construction of keepers' dwellings at Goat Island Lighthouse Depot, Calif.	16, 500
Constructing and equipping a lighthouse depot at Honolulu, Hawaii.....	120, 000

The act of June 5, 1920, also authorized the establishment of post lights and other aids to navigation on the Yukon River and its tributaries. This act also authorized an increase in the salary of the superintendent of naval construction.

The appropriations for the maintenance of the Lighthouse Service for the fiscal year 1921 are shown in tables on page 19.

The statistics as to the various classes of aids to navigation and fuller details on many of the subjects mentioned in this report will be found in the pages following.

Respectfully,

GEORGE R. PUTNAM,
Commissioner of Lighthouses.

To Hon. J. W. ALEXANDER,
Secretary of Commerce.

STATISTICS AND ESTIMATES.

LIST OF OFFICERS OF THE BUREAU OF LIGHTHOUSES AND THE LIGHTHOUSE DISTRICTS.

OFFICERS OF THE BUREAU OF LIGHTHOUSES ON JUNE 30, 1920.

George R. Putnam.....Commissioner of Lighthouses.
John S. Conway.....Deputy Commissioner.
H. B. Bowerman.....Chief Constructing Engineer.
Edward C. Gillette.....Superintendent of Naval Construction.

Principal Assistant Engineer, Rudolph Zirpel.
Superintendent on general duty, E. M. Trott.
Chief Clerk, Thaddeus S. Clark.
Examiner, Thomas Flood.

SUPERINTENDENTS OF LIGHTHOUSE DISTRICTS JULY 1, 1919, TO JUNE 30, 1920.

District.	Name.	From—	To—
1st.....	C. E. Sherman.....	July 17, 1911	
2d.....	G. E. Eaton.....	Mar. 7, 1919	
3d.....	J. T. Yates.....	June 29, 1912	
4th.....	B. B. Dorry.....	July 1, 1919	
5th.....	H. D. King.....	Jan. 28, 1915	
6th.....	H. L. Beck.....	Jan. 28, 1915	
7th.....	W. W. Demeritt.....	Aug. 22, 1913	
8th.....	E. S. Lanphier.....	Jul. 1, 1919	
9th.....	F. C. Hingsburg.....	Jan. 28, 1918	Sept. 6, 1920
	F. P. Dillon.....	Sept. 7, 1920	
10th.....	Roscoe House.....	June 4, 1912	
11th.....	E. L. Woodruff.....	Aug. 19, 1912	
12th.....	C. H. Hubbard.....	May 1, 1918	
13th.....	Col. H. Burgess, Corps of Engineers, U. S. Army.....	June 9, 1919	
14th.....	Col. Lansing H. Peach, Corps of Engineers, U. S. Army.....	Aug. 19, 1915	Apr. 21, 1920
	Maj. W. P. Stokey, Corps of Engineers, U. S. Army.....	Apr. 22, 1920	
15th.....	Col. C. McD. Townsend, Corps of Engineers, U. S. Army.....	Feb. 1, 1919	Apr. 5, 1920
	Col. Chas. L. Potter, Corps of Engineers, U. S. Army.....	Apr. 6, 1920	
16th.....	W. C. Dibrell.....	Aug. 22, 1913	
17th.....	Robert Warrack.....	Feb. 1, 1915	
18th.....	H. W. Rhodes.....	July 6, 1912	
19th.....	A. E. Arledge.....	Sept. 3, 1912	

JURISDICTION OF LIGHTHOUSE SERVICE.

The United States Lighthouse Service is charged with the establishment and maintenance of aids to navigation and with all equipment and work incident thereto on the sea and lake coasts of the United States, on the rivers of the United States so far as specifically authorized by law, and on the coasts of all other territory under the jurisdiction of the United States, with the exception of the Philippine Islands and Panama. The total length of coast line and rivers under the United States Lighthouse Service, measured by steps of 3 miles, is approximately 49,012 statute miles, including 1,712 miles of the Yukon River and its tributaries.

LIMITS OF LIGHTHOUSE DISTRICTS AND ADDRESSES OF SUPERINTENDENTS OF LIGHTHOUSES.

District.	Limits of district.	Address of superintendents.
1st.....	Waters of Maine and New Hampshire.....	Y. M. C. A. Building, Portland, Me.
2d.....	Waters of Massachusetts.....	Customhouse, Boston, Mass.
3d.....	Waters of Rhode Island, Connecticut, New York, and New Jersey northward of Cape May.	Tompkinsville, N. Y.
4th.....	Waters of Delaware seacoast and Delaware Bay and River.	Post Office Building, Philadelphia, Pa.
5th.....	Waters of Maryland, Virginia, and North Carolina to and including New River Inlet, N. C.	New Customhouse, Baltimore, Md.
6th.....	Waters of North Carolina, South Carolina, Georgia, and Florida, from New River Inlet, N. C., to Hillsboro Inlet, Fla.	Old Post Office Building, Charleston, S. C.
7th.....	Waters of Florida from Hillsboro Inlet to Cedar Keys..	Key West, Fla.
8th.....	Waters of Gulf Coast from Cedar Keys, Fla., to mouth of Rio Grande, Tex., and Mississippi River below New Orleans.	Customhouse, New Orleans, La.
9th.....	Waters of Porto Rico and adjacent United States islands.	San Juan, P. R.
10th.....	United States waters of St. Lawrence River and Lakes Ontario and Erie.	Federal Building, Buffalo, N. Y.
11th.....	United States waters of Lakes St. Clair, Huron, and Superior, and Detroit River.	Post Office Building, Detroit, Mich.
12th.....	Waters of Lake Michigan and Green Bay.....	Federal Building, Milwaukee, Wis.
13th.....	Mississippi River above the mouth of the Missouri River, Minnesota, Illinois, Osage, Gasconade, and Missouri Rivers, St. Croix River and Lake.	Federal Building, Rock Island, Ill.
14th.....	Ohio, Tennessee, Kanawha, and Monongahela Rivers.	Customhouse, Cincinnati, Ohio.
15th.....	Mississippi River below the Missouri River to New Orleans, La., and Red River.	Title Guaranty Building, St. Louis, Mo.
16th.....	Waters of Alaska.....	Ketchikan, Alaska.
17th.....	Waters of Washington and Oregon.....	Customhouse, Portland, Oreg.
18th.....	Waters of California.....	Customhouse, San Francisco, Calif.
19th.....	Waters of Hawaiian, Midway, Guam, and American Samoan Islands.	McCandless Building, Honolulu, Hawaii.

LIGHTHOUSE DEPOTS MAINTAINED ON JUNE 30, 1919.

[The principal depot of the district is indicated by the larger type.]

District.	Location.	District.	Location.
1st.....	Bear Island, Me. LITTLE DIAMOND ISLAND, ME.	8th.....	Fort San Jacinto, Galveston, Tex.
2d.....	LOVELLS ISLAND, BOSTON, MASS.		Mobile, Ala.
3d.....	Woods Hole, Mass. Atlantic City, N. J. Goat Island, R. I. Juniper Island, Vt. New London, Conn. TOMPKINSVILLE, STATEN ISLAND, N. Y. Tucker Beach, N. J.	9th.....	PORT EADS, LA.
4th.....	EDGEMOOR, DEL. Lewes, Del.	10th.....	SAN JUAN, P. R.
5th.....	Annapolis, Md. Lazaretto Point, Md. Point Lookout, Md. PORTSMOUTH, VA. Washington Wharf, D. C. Washington, N. C.		BUFFALO, N. Y.
6th.....	CHARLESTON, S. C.		Erie, Pa.
7th.....	Egmont Key, Fla. KEY WEST, FLA.	11th.....	Maumee Bay, Ohio.
			Rock Island, N. Y.
			Sandusky Bay (Cedar Point), Ohio.
		12th.....	DETROIT, MICH.
			Minnesota Point, Minn.
		13th.....	St. Marys River, Mich.
			Chalrevoix, Mich.
		14th.....	MILWAUKEE, WIS.
			KETCHIKAN, ALASKA.
		15th.....	Ediz Hook, Wash.
			TONGUE POINT, OREG.
		16th.....	GOAT ISLAND, CALIF.
		17th.....	HONOLULU, HAWAII.

EXPLANATION OF TABLE ON PAGE 27.

The table of aids to navigation includes all those maintained by the Lighthouse Service, a total of 16,324. On page 34 are given facts regarding the private aids to navigation, 749 in number, maintained under authority. In the statistics relief light vessels are not counted and duplicate or auxiliary lights and fog signals are not counted, but double lights are counted separately when maintained on distinct structures or for distinct purposes. Buoys for the purpose of marking the positions of light vessels or larger buoys are not counted. Fog signals at light stations or on vessels are counted as separate aids, but not those attached to buoys, except in the case of submarine bells, which are counted as separate signals, whether on vessels or on buoys. Otherwise each buoy is counted only once, and if it is included in a higher class it is not in the lower class. Light-vessel lights are not counted separately.

[See note on p. 26.]

Class.	1st dist.	2d dist.	3d dist.	4th dist.	5th dist.	6th dist.	7th dist.	8th dist.	9th dist.	10th dist.	11th dist.	12th dist.	13th dist.	14th dist.	15th dist.	16th dist.	17th dist.	18th dist.	19th dist.	Total.
LIGHTED AIDS.																				
Hyper-radiant lights.																				
First-order lights.	2	5	5	2	8	8	6	3									9		1	1
Second-order lights.	7	3	2			2	1	2	1									1		57
Third-order lights.	6		3	2		3	4	8	6								2	4	2	26
Three and one-half-order lights.		2	1	3	1			3	1										1	67
Fourth-order lights.	35	25	58	9	49	2	4	12	4	21	3	6					2		1	24
Fifth-order lights.	18	15	18	4	23	3	1	13	3	9	13	37					19		9	356
Sixth-order lights.	1	5	21	2	8				4	8	3	15						20		131
Range-lens lights.																				67
Reflector lights.	2	7	9	15	5	9														49
Lens-lantern lights.	12	27	82	21	49	37	13	8	2		29	4					2			139
Minor lights.	3	18	145	27	304	180	71	91	20		94	50					34	40	39	901
Electric lights without lens.	1										79	7					300	14	2	3,118
Light-vessel stations.	1	11	10						5								8		2	18
Gas-lighted buoys.	5	40	52	15	65	9	6	28	5		78	16					3	2		49
Gas and whistling buoys.	7	6	11		12	8	5	7	1								12	8	6	381
Gas and aerial bell buoys.		8	23	7	21	8	6	5									7	9		75
Float lights.											11	17					6	6	1	126
Total.	100	173	441	118	565	838	154	367	53	153	385	183	578	615	762	296	495	116	64	5,754
Lights on fixed aids.	87	108	345	96	411	399	137	323	46	97	287	138	406	578	762	190	376	91	57	4,954
Lights on floating aids.	13	65	96	22	194	29	17	42	7	56	98	45	92	37		16	29	25	7	800
Totallighted aids.	100	173	441	118	565	838	154	365	53	153	385	183	558	615	762	296	495	116	64	5,754
UNLIGHTED AIDS.																				
Fog signals, engine power.	19	21	37	5	14	4		4												26
Fog signals, clock power.	37	14	59	6	62	3	1	14									2	6		226
Fog signal, compressed gas.					1															1
Fog signals, hand power.	12	1	2																	17
Fog signals, electric.		6	4	1	3															26
Submarine signals.	2	8	9		7	5		2									1	4		48
Buoys, whistling (unlighted).	19	10	8		2	5	3	5	1								8	2		78
Buoys, bell (unlighted).	52	37	57	5	23	9	7	14	4								17			243
Buoys, iron.	143	65	171	196	25	300	216	171	133	10	26	29				171	124	60	64	2,054
Buoys, spar (wood).	715	616	964	101	1,065	5		239		158	488	137				48	135	32	12	5,141
Daymarks, beacons, etc.	177	75	4	1	373	552	343	243	6		4	8				96	78	31	42	2,470
Total unlighted aids.	1,176	853	1,291	225	1,761	883	570	692	144	185	555	237	886	60		329	387	198	118	10,570
Grand total.	1,276	1,026	1,732	343	2,326	1,221	724	1,057	197	338	960	420	1,444	675	762	535	792	314	182	16,324

DETAILS AS TO CHARACTERISTICS OF LIGHTS (NOT INCLUDING LIGHT VESSELS).¹

	1st dist.	2d dist.	3d dist.	4th dist.	5th dist.	6th dist.	7th dist.	8th dist.	9th dist.	10th dist.	11th dist.	12th dist.	16th dist.	17th dist.	18th dist.	19th dist.	Total.
Fixed white:																	
Sixth order and above...	31	29	51	16	50	25	4	28	5	21	27	23	2	3	2	4	330
Below the sixth order...	1	10	72	9	230	139	52	145	5	5	61	6	50	214	17	11	1,027
Lighted buoys...		1	5					1		10	2	5	2				26
Fixed red:																	
Sixth order and above...	14	10	22	2	18	29	9	8	2	16	34	27		3		3	183
Below the sixth order...	5	13	99	9	100	80	31	113	8	16	63	16	5	100	23	9	693
Lighted buoys...		1	8						1	12	3		6	1			32
Fixed green:																	
Below the sixth order...									1								1
Flashing or occulting:																	
Sixth order and above...	15	18	40	30	28	19	15	10	8	18	43	18	7	25	34	7	335
Below the sixth order...	9	22	56	30	23	23	22	16	14	19	49	31	125	28	15	23	508
Lighted buoys...	12	52	73	22	98	25	17	39	6	34	89	34	9	25	23	7	565
Fixed and flashing, sixth order and above...	12	6	5		3	3	1	3	3	2	10	14		3			65
Candlepower:																	
50,000 to 190,000...	5	4	4	7	4	6	5	5	3	4	7	1	1	2	9	1	68
200,000 to 190,000...		1	2	1	1	1	1	1			3	1	1	1	2	1	17
500,000 and over...		1	1													1	3
Twin light stations...	2	3															5
Stations with resident keepers...	70	47	112	33	83	22	12	50	21	35	72	66	10	35	39	14	721

DETAILS AS TO ILLUMINANTS OF LIGHTS (NOT INCLUDING LIGHT VESSELS).¹

	1st dist.	2d dist.	3d dist.	4th dist.	5th dist.	6th dist.	7th dist.	8th dist.	9th dist.	10th dist.	11th dist.	12th dist.	16th dist.	17th dist.	18th dist.	19th dist.	Total.
Incandescent oil vapor...	28	25	39	19	19	15	11	13	11	9	39	29	5	25	27	6	320
Oil (wick lamp):																	
Sixth order and above...	13	30	76	6	69	40	12	29	7	34	34	39	1	1	1	7	441
Below the sixth order...	6	15	136	16	311	219	86	228	9	17	98	18	56	295	36	14	1,580
Lighted buoys...									1	22	5	5	6	1			40
Acetylene:																	
Sixth order and above...		3	2	14	11	12	4	7		5	18	4	3	2	1	1	87
Below the sixth order...	9	22	67	28	23	23	22	46	11	17	29	34	124	19	11	23	510
Lighted buoys...	7	29	46	11	59	25	14	16			24	8	10	21	11	7	288
Oil gas:																	
Lights with mantles...									1		49						50
Lights without mantles...					15						1						16
Lighted buoys with mantles...	1		8	2	35			2	2	34	65	24		4	7		183
Lighted buoys without mantles...	1	25	32	9	4		3	22	6			2			5		112
Electric arc:																	
Sixth order and above...															1		1
Below the sixth order...														2			2
Electric incandescent:																	
Sixth order and above...	1	3	1	9	9		2			9	15	11		5	5		68
Below the sixth order...		8	3	4	3				7	6	4	4	1	26	6	6	78
Gas (coal), sixth order and above...		2										1					3
Gas (oil), below sixth order...			1														1

¹ Does not include the thirteenth, fourteenth, and fifteenth lighthouse (river) districts, in which there are 1,806 lights on fixed aids and 129 lights on floating aids, all of which use kerosene and are fixed, excepting 5, which use acetylene and are flashing, and 1 which uses electricity.

DETAILS AS TO LIGHTS ON LIGHT VESSELS.

	1st class.	2d class.	3d class.	4th class.	5th class.	6th class.	11th class.	12th class.	13th class.	14th class.	Total.
Characteristics as to lights:											
1 fixed white light.....		1					2				3
2 fixed white lights.....			1					1			2
1 fixed red light.....				1		1					2
1 fixed white and 1 fixed red light.....					1						1
1 white flashing, or revolving, and 1 fixed red light.....											
1 white light, flashing or revolving.....	1	1		1		1	1	1		1	6
2 white lights, flashing or revolving.....											
Apparatus:											
Uncondensed oil lamp.....	1	1				1					3
Acetylene.....											
Oil (kerosene).....		1									1
Oil (gas).....				1	1		2	2			6
Oil (gas) and acetylene.....											
Electric arc.....											
Electric incandescents.....		1									1
Decorative apparatus:											
Powerful color.....		1		1	1	1		1			5
Reflector.....		1					2		1		4
Reflector and lens lantern.....											
Lens lantern.....	1	1			2	1	2	2	2	2	13

DETAILS AS TO FOG SIGNALS.

Kind and how operated.	1st class.	2d class.	3d class.	4th class.	5th class.	6th class.	7th class.	8th class.	9th class.	10th class.	11th class.	12th class.	Total.
Steam:													
Whistle.....	1	1			1			2	2				6
Bell.....													
Air:													
Whistle.....	1	1		1	1								4
Bell.....													
Gong.....													
Steam whistle.....				1									1
Steam horn.....	1	1		1	1								4
Electric bell:													
On light vessels, driven by compressed air.....	1	1	1		1		2				1		6
On buoys, electric power.....													
On buoys, operated by air.....	1	1	2		1								5
Mechanical:													
Clockwork.....	20	14	26	6	42	2	14	2	5	9	1	1	107
Electric.....													
Operated by gas.....													
Signal.....	15	1	2										18
Hand:													
Hand.....									1	1			2
Total.....	78	30	33	12	57	12	1	20	10	11	22	12	265

* Auxiliary fog signals (70), buoys with whistles (132), and buoys with bells (266) are not included.

LIGHTS ESTABLISHED DURING THE FISCAL YEAR 1909.

(173 lights.)

District.	Location.	Order.
2d.	Anson's Nose, Hudson River, N. Y.	Lens lantern (acetylene).
	Cox Hollow Bar (2 lights), Connecticut River, Conn.	Minor.
	Magazine Point, Hudson River, N. Y.	Lens lantern (acetylene).
	North Brother Island, East River, N. Y.	Do.
4th.	Schooner Wreck, Upper Bay, N. Y.	Minor.
	Sloop Wreck, Baltimore Harbor, Md.	Do.
	Swallow, North River, N. C.	Do.
	Cherrytree Bar, Chesapeake Bay, Va.	Lens lantern (acetylene).

LIGHTS ESTABLISHED DURING THE FISCAL YEAR 1920—Continued.

District.	Location.	Order.
5th.....	Far Creek, Pamlico Sound, N. C.....	Minor.
	Messick Point, Back River, Va.....	Do.
	Old Toms, Indian Creek, Va.....	Do.
	Pingleton Shoal, Pamlico Sound, N. C.....	Do.
	Sallie Purnell Reswick Wreck, Chesapeake Bay, Md.....	Do.
	Swan Quarter Bay, N. C.....	Do.
	Swash-ray, Back Creek, Va.....	Do.
	Trent River (3 lights), N. C.....	Do.
6th.....	Dame Point (2 lights), St. Johns River, Fla.....	Do.
7th.....	Moorehaven Channel, Lake Okeechobee, Fla.....	Do.
8th.....	Belle Air, Mississippi River, La.....	Lens lantern.
	Caucus Cut Range Front, Pensacola, Fla.....	Lens lantern (acetylene).
	Cypress Range (2 lights), Mississippi River, La.....	Lens lantern.
	Deer Range, Mississippi River, La.....	Do.
	Fort McRae Cutoff Range Front, Pensacola, Fla.....	Lens lantern (acetylene).
	Huling, Mississippi River, La.....	Lens lantern.
	Oak Point, Mississippi River, La.....	Do.
	West Pointe a La Hache, Mississippi River, La.....	Do.
10th.....	Huron Harbor, Ohio.....	Lens lantern (electric incandescent).
	Dundern Wreck, Lake Erie, Ohio.....	Minor.
11th.....	Pipe Island Twins, St. Marys River, Mich.....	Lens lantern (acetylene).
	Squaw Island, St. Marys River, Mich.....	Do.
12th.....	City of Muskegon Wreck, Muskegon Harbor, Mich.....	Minor.
	East Pier Head, Indiana Harbor, Ind.....	Lens lantern (acetylene).
13th.....	13 lights.....	Minor.
	16 lighted spars.....	Do.
14th.....	15 lights.....	Do.
	2 float lights.....	Do.
15th.....	39 lights.....	Do.
16th.....	Angle Point, Revillagigedo Channel, Alaska.....	Lens lantern (acetylene).
	Bar Point Float, Tongass Narrows, Alaska.....	Minor.
	Cape Ommaney, Chatham Strait, Alaska.....	Lens lantern (acetylene).
	Cape Panofot, Unimak Island, Alaska.....	Do.
	Chisik Island, Cook Inlet, Alaska.....	Minor.
	Duck Point, Stephens Passage, Alaska.....	Do.
	Gambier Bay Entrance, Gambier Bay.....	Do.
	Hood Bay, Chatham Strait, Alaska.....	Do.
	Lisianski Strait Entrance, Alaska.....	Lens lantern (acetylene).
	New Year Islands, Prince William Sound, Alaska.....	Do.
	Old Sitka Rock, Sitka Sound, Alaska.....	Do.
	Point Colpoys, Sumner Strait, Alaska.....	Do.
	Port Alexander, Chatham Strait, Alaska.....	Minor.
	Pybus Bay, Alaska.....	Do.
	Sanak Island, Aleutian Islands, Alaska.....	Do.
	Sukkwon Narrows, Sukkwon Strait, Alaska.....	Do.
	Surprise Point, Dixon Entrance, Alaska.....	Do.
17th.....	Barretts, Umpqua River, Oreg.....	Do.
	Camas, Columbia River, Wash.....	Do.
	Cannery Landing, Coquille River, Oreg.....	Do.
	Cannery Sands, Umpqua River, Oreg.....	Do.
	Deer Island Upper Dike, Columbia River, Oreg.....	Do.
	Double Cove Point, Umpqua River, Oreg.....	Do.
	Everett Jetty, Everett Harbor, Wash.....	Lens lantern (acetylene).
	Fort Canby, Columbia River, Wash.....	Minor (electric incandescent).
	Fort Canby Wharf, Columbia River, Wash.....	Minor.
	Goble Crossing, Columbia River, Oreg.....	Do.
	Ilwaco, Columbia River, Wash.....	Do.
	Ilwaco Channel (2 lights), Columbia River, Wash.....	Do.
	Kalama Channel South Range (2 lights), Columbia River, Wash.....	Minor (electric incandescent).
	Kalama River, Wash.....	Minor.
	Lake Union, Wash.....	Lens lantern (acetylene).
	Leeds Island, Umpqua River, Oreg.....	Minor.
	Martin Dike, Columbia River, Wash.....	Do.
	Parkersburg, Coquille River, Oreg.....	Do.
	Perkins Landing, Coquille River, Oreg.....	Do.
	Ranholm Slough, Coquille River, Oreg.....	Do.
	St. Helens Jetty, Columbia River, Wash.....	Do.
	Three Mile, Umpqua River, Oreg.....	Do.
	Walker Island Dike, Columbia River, Oreg.....	Do.
	Walstrom Landing, Coquille River, Oreg.....	Do.
	Webster Point, Lake Washington Canal, Wash.....	Lens lantern (acetylene).
	Westport Crossing, Columbia River, Oreg.....	Minor.
	Willow Bar Dike, Columbia River, Oreg.....	Do.
	Youngs Bay Entrance, Columbia River, Oreg.....	Do.
18th.....	Oakland Shoal, San Francisco Bay, Calif.....	Lens lantern (acetylene).
	Ruticon Point, Lake Tahoe, Calif.....	Do.
19th.....	Kaena, Oahu Island, Hawaii.....	Do.

LIGHTS WHERE ILLUMINATION WAS IMPROVED DURING THE FISCAL YEAR 1920.**FLASHING OR OCCULTING LIGHTS CHANGED FROM FIXED LIGHTS (44 LIGHTS).**

District.	Location.	District.	Location.
2d.....	Mayo Beach, Mass. Stone Horse Shoal Light Vessel No. 5, Nantucket Sound, Mass. Vineyard Sound Light Vessel No. 90, Mass.	3d.....	Stonehouse Bar Dike, Hudson River, N. Y. Sunken Meadow, East River, N. Y. Upper Coal Beds, Hudson River, N. Y. Van Wies Point Dike, Hudson River, N. Y. West Flats, Hudson River, N. Y. Whipple Point, Lake Memphremagog, Vt.
3d.....	Bear Island, Hudson River, N. Y. Canarsie Pike, Jamaica Bay, N. Y. Catskill West Flats, Hudson River, N. Y. Coeysman Bar, Hudson River, N. Y. Con Hook, Hudson River, N. Y. Cow Island, Hudson River, N. Y. Esopus Island, Hudson River, N. Y. Essex Reef, Conn. River, Conn. Five-Hook Island, Hudson River, N. Y. Four-Mile Point, Hudson River, N. Y. Lawrence Point Ledge, East River, N. Y. Livingston Creek, Hudson River, N. Y. Mill Rock Northerly, East River, N. Y. New Baltimore, Hudson River, N. Y. Nine-Mile Tree, Hudson River, N. Y. Percy Reach, Hudson River, N. Y. Ram Island Reef Light Vessel No. 23, N. Y. Raritan River, N. J. (3 lights). South Brother Island Ledge, East River, N. Y.	5th.....	Cherrystone Bar, Chesapeake Bay, Va. Jones Point, Potomac River, Va. New Point Comfort, Chesapeake Bay, Va. White Stone Point, Potomac River, Va. Frying-Pan Shoals Light Vessel No. 94, N. C. 10th.....
		11th.....	Fort Niagara, N. Y. Vermilion, Lake Erie, Ohio. Ecorse, Detroit River, Mich. Grosse Isle, Detroit River, Mich. 16th.....
			Burnett Inlet Float, Clarence Strait, Alaska. Inner Point Sophia, Icy Strait, Alaska. Pastol Bay Range Front, Yukon River, Alaska. Red Bluff Bay, Chatham Strait, Alaska. Rose Inlet, Tlevak Strait, Alaska.

INCANDESCENT OIL-VAPOR LIGHTS CHANGED FROM OIL-WICK LIGHTS (3 LIGHTS)

4th.....	Marcus Hook Range Rear, Delaware River, Del.	16th.....	Cape Sarichef, Unimak Island, Alaska Scotch Cap, Unimak Island, Alaska.
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ACETYLENE OR OTHER LIGHTS CHANGED FROM OIL-WICK LIGHTS, ETC. (60 LIGHTS).

2d.....	Mayo Beach, Mass. Stone Horse Shoal Light Vessel No. 5, Nantucket Sound, Mass. Vineyard Sound Light Vessel No. 90, Mass.	5th.....	Jones Point, Potomac River, Va. New Point Comfort, Chesapeake Bay, Va. White Stone Point, Potomac River, Md.
3d.....	Bear Island, Hudson River, N. Y. Canarsie Pike, Jamaica Bay, N. Y. Catskill West Flats, Hudson River, N. Y. Coeysman Bar, Hudson River, N. Y. Con Hook, Hudson River, N. Y. Cow Island, Hudson River, N. Y. Esopus Island, Hudson River, N. Y. Essex Reef, Conn. River, Conn. Five-Hook Island, Hudson River, N. Y. Four-Mile Point, Hudson River, N. Y. Lawrence Point Ledge, East River, N. Y. Livingston Creek, Hudson River, N. Y. Mill Rock Northerly, East River, N. Y. New Baltimore, Hudson River, N. Y. Nine Mile Tree, Hudson River, N. Y. Percy Reach, Hudson River, N. Y. Ram Island Reef Light Vessel No. 23, N. Y. Raritan River (3 lights), N. J. South Brother Island Ledge, East River, N. Y. Stonehouse Bar Dike, Hudson River, N. Y. Sunken Meadow, East River, N. Y. Upper Coal Beds, Hudson River, N. Y. Van Wies Point Dike, Hudson River, N. Y. West Flats, Hudson River, N. Y. Whipple Point, Lake Memphremagog, Vt.	6th.....	Frying Pan Shoals Light Vessel No. 94, N. C. (from l. o. v.). 10th.....
			Fort Niagara, Lake Ontario, N. Y. (electric incandescent). Niagara River Range (2 lights), N. Y. (electric incandescent). Strawberry Island Upper Range (2 lights), Niagara River, N. Y. (electric incandescent). Vermilion, Lake Erie, Ohio. 11th.....
			Cedar Point Range (2 lights), St. Marys River, Mich. Ecorse, Detroit River, Mich. Grassy Island, Detroit River, Mich. Grosse Isle, Detroit River, Mich. Windmill Point, Detroit River, Mich. (electric incandescent). Windmill Point Range (2 lights), Detroit River, Mich. (electric incan- descent). 12th.....
			Keweenaw Pierhead, Lake Michigan, Mich. (electric incandescent). Keweenaw Range Rear, Lake Michigan, Mich. (electric incandescent). Manitowoc Breakwater, Lake Michigan, Mich. (electric incandescent). 16th.....
4th.....	Mud Island Range Front, Delaware River, Pa. (from electric incandes- cent).		Burnett Inlet Float, Clarence Strait, Alaska. Inner Point Sophia, Icy Strait, Alaska. Pastol Bay Range Front, Yukon River, Alaska. Red Bluff Bay, Chatham Strait, Alaska. Rose Inlet, Tlevak Strait, Alaska. 17th.....
5th.....	Cherrystone Bar, Chesapeake Bay, Va. Fort Washington, Potomac River, Md. (electric incandescent).		Cape Disappointment, seacoast of Wash. (electric incandescent from l. o. v.).

LIGHTS DISCONTINUED DURING THE FISCAL YEAR 1920.

[110 lights, including float lights.]

District.	Location.	Order.
3d.....	Canarsie Channel, Jamaica Bay, N. Y.....	Minor.
	Mary A. Hall Wreck, Lower Bay, N. Y.....	Do.
	Naubuc Range, (2 lights), Connecticut River, Conn.....	Do.
	Nestepol Bar Light, Jamaica Bay, N. Y.....	Do.
	Nova Scotia Bar, Jamaica Bay, N. Y.....	Do.
	Oak Bluff, East River, N. Y.....	Do.
	Schooner Wreck, Upper Bay, N. Y.....	Do.
	Sloop Bar Hassock, Jamaica Bay, N. Y.....	Do.
	Watermans Bar, Jamaica Bay, N. Y.....	Do.
5th.....	Barre Wreck, Chesapeake Bay, Md.....	Do.
	Blackwalnut Point Shoal, Choptank River, Md.....	Lens lantern (acetylene).
	Cherrystone Light Station, Va.....	5th.
	Elbow of York Spit, Va.....	Lens lantern (acetylene).
	J. Manco Wreck, Pamlico Sound, N. C.....	Minor.
	Occoquan Bay, Potomac River, Va.....	Do.
	Sallie Purnell Beswick Wreck, Chesapeake Bay, Md.....	Do.
7th.....	Fisheating Creek, Lake Okeechobee, Fla.....	Do.
	Grass Islands, Lake Okeechobee, Fla.....	Do.
	Kissimmee River, Lake Okeechobee, Fla.....	Do.
	Miami Side Entrance Range (2 lights), Fla.....	{ Do.
	New River Canal, Lake Okeechobee, Fla.....	Lens lantern.
	Three Mile Canal, Lake Okeechobee, Fla.....	Minor.
8th.....	Caucus Cut Range Front, Pensacola, Fla.....	Do.
10th.....	Conneaut West Pierhead Construction, Ohio.....	Lens lantern.
	Dundern Wreck, Lake Erie, Ohio.....	Minor.
	Horseshoe Reef, Buffalo Harbor, N. Y.....	Do.
11th.....	Old Channel (2 lights), Lake St. Clair, Mich.....	4th (acetylene).
	St. Clair Flats Canal East Pierhead, Mich.....	Minor.
	Superior Harbor Basin, Wis.....	Lens lantern.
12th.....	City of Muskegon Wreck, Muskegon Harbor, Mich.....	Minor.
13th.....	4 lights.....	Do.
	7 lighted spars.....	Do.
14th.....	5 lights.....	Do.
	5 float lights.....	Do.
15th.....	43 lights.....	Do.
16th.....	Windy Bay, Orca Bay, Alaska.....	Do.
17th.....	Ballast Point, Umpqua River, Oreg.....	Do.
	Enterprise Landing Range (2 lights), Columbia River, Oreg.....	Do.
	Goble Range (2 lights), Columbia River, Oreg.....	Do.
	Hunter Bar, Columbia River, Oreg.....	Do.
	Lake Union, Wash.....	Lens lantern (acetylene).
	Port Crescent, Juan de Fuca Strait, Wash.....	Minor.
	Slaughters Bar Upper Range (2 lights), Columbia River, Oreg.....	Do.
	Washougal Upper, Columbia River, Oreg.....	Do.
18th.....	Mare Island Dike, Napa River, Calif.....	No lens (electric incandescent).

GAS BUOYS ESTABLISHED AND DISCONTINUED DURING THE FISCAL YEAR 1920.

District.	Location.	District.	Location.
	ESTABLISHED (60).		ESTABLISHED (60)—continued.
1st.....	Dredged Channel, Portland Harbor, Me.	12th.....	Oconto Harbor (bell), Green Bay, Wis.
2d.....	Oakwoods Wreck, Buzzards Bay, Mass.	16th.....	Bligh Island Reef (bell), Prince William Sound, Alaska.
	Tabor Wreck, Vineyard Sound, Mass.		Favorite Reef (bell), Stephens Passage, Alaska.
	Three-Fathom Spot, Nantucket Sound, Mass.		Hanks Island Rock (bell), Prince William Sound, Alaska.
3d.....	Aspinet Wreck, Hudson River, N. Y.	17th.....	Crescent Bay (bell), Wash.
	Broad Channel, Jamaica Bay, N. Y.		Clatsop Spit (2 buoys, 1 whistle), Columbia River, Oreg.
	Conimicut Middle Ground (bell), Narragansett Bay, R. I.		Desdemona Sands, Columbia River, Oreg.
	Jockey Wreck, Lower Bay, N. Y.		State of Washington Wreck, Columbia River, Oreg.
	Long Sand Shoal West End (bell), Long Island Sound, Conn.	18th.....	San Diego Bay Entrance (whistle), Calif.
	Mary A. Hall Wreck, Lower Bay, N. Y.		Suisun Bay, Calif.
	Nestepol Bar, Jamaica Bay, N. Y.		
	Nova Scotia Bar, Jamaica Bay, N. Y.		DISCONTINUED (32).
	Savbrook Bar (bell), Long Island Sound, Conn.	2d.....	Governor Powers Wreck, Nantucket Sound, Mass.
4th.....	Watermans Bar, Jamaica Bay, N. Y.		Oakwoods Wreck, Buzzards Bay, Mass.
	Baker Range, Delaware River, Del.		Tabor Wreck, Vineyard Sound, Mass.
	Deadman Shoal, Delaware Bay, N. J.	3d.....	Aspinet Wreck, Hudson River, N. Y.
	Fagle 25 Wreck, Delaware River, Del.		Conimicut Middle Ground, Narragansett Bay, R. I.
	Joe Flogger Shoal (2 buoys), (bell), Delaware Bay, Del.		Long Sand Shoal West End, Long Island Sound, Conn.
	Marcus Hook Range, Delaware River, N. J.		Marietta Wreck, Long Island Sound, Conn.
5th.....	Blackwalnut Point Shoal, Choptank River, Md.		Obstruction, seacoast of N. Y.
	Cape Lookout Breakwater (whistle), seacoast of N. C.	4th.....	Schooner Wreck, seacoast of N. J.
	Cherry-stone Flats, Chesapeake Bay, Va.		Joe Flogger Shoal (bell), Delaware Bay, Del.
	Lake Calvenia Wreck, Hampton Roads, Va.	5th.....	Scully Wreck (bell), Delaware Bay, Del.
	Loonst Point Flats, Susquehanna River, Md.		Cherubim Wreck, Chesapeake Bay, Va.
	Neosho Wreck, seacoast of Del.		Neosho Wreck, seacoast of Del.
	17-Foot Lump (bell), Chesapeake Bay, Va.		Socony Wreck, off Rappahannock River, Va.
	Socony Wreck, off Rappahannock River, Va.		Thimble Shoal Dredged Channel, Va.
	Thimble Shoal Dredged Channel (bell), Hampton Roads, Va.		35-Foot Channel, Chesapeake Bay, Va.
	35-Foot Channel (bell), Chesapeake Bay, Va.		Tug Hopewell Wreck, Chesapeake Bay, Va.
	Tug Hopewell Wreck, Chesapeake Bay, Va.		William W. Curtin Wreck, off Kent Island, Md.
	William W. Curtin Wreck, off Kent Island, Md.	6th.....	Drum Island, Cooper River, S. C.
6th.....	Barnstable Wreck, seacoast of Ga.	7th.....	Sand Key Ridge West End (bell), Florida Reefs.
	Drum Island, Cooper River, S. C.	8th.....	Aransas Pass (whistle), Tex.
8th.....	Alligator Point, Lake Borgne, La.		Brazos River (whistle), Tex.
	Aransas Pass (bell), Tex.		Galveston, Tex.
	Brazos River (bell), Tex.	10th..	Dundurn Wreck, Ashtabula Harbor, Ohio.
	Galveston North Channel (2 buoys), Tex.	11th.....	Pine Island Twins, St. Marys River, Mich.
	Grand Batture Island Shoal, Mississippi Sound, Miss.		Squaw Island, St. Marys River, Mich.
	St. Andrews Bay Entrance (3 buoys, 1 a bell), Fla.	12th.....	Chicago Harbor Breakwater, Ill.
10th.....	Dundurn Wreck, Ashtabula Harbor, Ohio.		Desmond Wreck (bell), Calumet Harbor, Ill.
11th.....	St. Clair Flats Canal, Mich.	16th.....	Reef Island Reef, Prince William Sound, Alaska.
	Vidal Shoals Channel, St. Marys River, Mich.	17th.....	Columbia River Outside Bar (whistle), Oreg.
12th.....	Chicago Harbor Breakwater, Ill.		Desdemona Sands, Columbia River, Oreg.
	Lee Point (bell), Grand Traverse Bay, Mich.	18th.....	North Channel, Suisun Bay, Calif.
	Northport Point (bell), Grand Traverse Bay, Mich.		

FOG SIGNALS ESTABLISHED, IMPROVED, AND DISCONTINUED DURING THE FISCAL YEAR 1920.

District.	Location.	Character.	
ESTABLISHED (5).			
2d.....	Brant Point, Mass.....	Bell operated by clockwork.	
	East Breakwater, Nantucket, Mass.....	Do.	
5th.....	Cherrystone Bar, Va.....	Bell operated by gas.	
8th.....	South Pass West Jetty Range Front, La.....	Air diaphone.	
11th.....	Alpena, Mich.....	Electric siren.	
IMPROVED (5).			
3d.....	New Haven, Conn.....	From— Air siren.	To— Air whistle.
11th.....	Harbor Beach, Mich.....	Steam whistle.	Air diaphone.
12th.....	Kewaunee Pierhead, Wis.....	Do.	Do.
	Mantowoc Breakwater, Wis.....	Do.	Do.
	Twin River, Lake Michigan, Mich.....	Do.	Do.
DISCONTINUED (2).			
5th.....	Fort McHenry, Md.....	Electric siren.	
11th.....	Bar Point Shoal Light Vessel No. 62.....	Steam whistle.	

LIGHT VESSEL DISCONTINUED DURING THE FISCAL YEAR 1920.

District.	Number of vessel.	Name of station.
11th.....	62	Bar Point Shoal, Detroit River, Mich.

SUBMARINE SIGNAL DISCONTINUED DURING THE FISCAL YEAR 1920.

District.	Location.
16th.....	Off Cape St. Elias, seacoast of Alaska.

PRIVATE AIDS TO NAVIGATION MAINTAINED ON JUNE 30, 1920.

[Under the act of June 20, 1906.]

District.	Lights.	Buoys.		Other unlighted aids.	Fog signals.	Total.
		Lighted.	Unlighted.			
1st.....			32	2		34
2d.....	39		42	6		87
3d.....	31	2	50	5	2	90
4th.....			4			4
5th.....	16		155	52	3	226
6th.....	2		10			12
7th.....	5		9	2		16
8th.....	13		20	7		40
9th.....			1			1
10th.....	23	4	6	1	1	35
11th.....	12	1	54	1		68
12th.....	34	3	11		7	55
13th.....		1				1
15th.....	1					1
15th.....	3		1			4
17th.....	1		12		2	15
18th.....	22	2	6	1	12	43
19th.....	17					17
Total.....	219	13	413	77	27	749

BRIDGES OVER NAVIGABLE WATERS LIGHTED ON JUNE 30, 1920.

[Under the act of Aug. 7, 1882, 22 Stat., 309.]

District.	Lighted bridges.	District.	Lighted bridges.	District.	Lighted bridges.
1st.....	23	7th.....	25	14th.....	187
2d.....	64	8th.....	261	15th.....	8
3d.....	214	10th.....	65	17th.....	55
4th.....	17	11th.....	53	18th.....	30
5th.....	159	12th.....	168		
6th.....	58	13th.....	80	Total.....	1,467

AIDS MAINTAINED UNDER CONTRACT DURING FISCAL YEAR 1920.

District.	Name of aids.	Annual cost.
1st.....	Kennebunkport Pier Light, Me.....	\$150.00
7th.....	Caximbas Pass and Big Marco Pass, Fla. (4 buoys).....	72.00
10th.....	Lake Ontario and the St. Lawrence River, N. Y. (41 buoys).....	3,000.00
	Niagara River and Black Rock Channel, N. Y. (75 buoys).....	202.00
11th.....	Superior Bay, St. Louis Bay and River, Wis. and Minn. (32 lights).....	3,000.00
12th.....	Fox River, Wis. (14 spar buoys); Green Bay, Wis. (17 spar buoys).....	250.00
16th.....	St. Michael Canal and Apoon Pass, Alaska (32 buoys), Orizaba Reef Bell Buoy and Norton Sound (11 lights).....	1,090.00
	Sitka Harbor Light, Alaska.....	60.00
	Akutan Harbor Light, Alaska.....	54.00

LIGHT VESSELS IN COMMISSION DURING THE FISCAL YEAR 1920.

Number	Station	Portage		Material of hull		Dimensions		Propulsion		For signal	Illustration	Cost of repairs made during fiscal year		Cost of maintenance during fiscal year		Original cost	On duty	
		Tons	Feet	Wood	Steel	Length	Beam	Power (H.P.)	Speed (kts.)			\$	cts.	\$	cts.		Months	Days
74	Portland, Me.	1	139	1907	Wood	125	9	24	10	12" steam whistle	Acet.	\$78	\$18,136	\$88,896		12		
3	Hamden, Ind. 6, May	2	149	1842	do	15	0	15	0	Bell	do	204	0,075	12,000		11		7
4	Reed	2	104	1871	do	16	0	20	0	Bell or horn	Oil	1,556	1,415			2		22
5	Stone Horse Shoal, Mass.	2	104	1861	do	16	0	21	0	8" air whistle	Acet.	2,455	11,496			9		29
20	Cross Key, Mass.	2	165	1867	do	18	0	21	0	Bell	do	3,048	11,477	25,040		9		19
9	Bridge Point, Mass.	2	104	1857	do	18	0	28	0	8" air whistle	Oil	78	13,003	19,853		12		
41	Amherst Sound, Mass.	2	187	1876	do	14	0	26	0	First-class air siren	Acet.	1,835	11,917	33,000		10		24
42	Long Point, Mass.	2	140	1877	do	14	0	26	0	10" air whistle	Oil	130	15,228	40,796		11		15
47	Pallack Key, Mass.	2	170	1891	Comp.	120	10	26	0	12" steam whistle	do	2,326	16,006	60,000		8		27
54	Boston, Mass.	2	410	1892	Steel	118	10	26	0	First-class air siren	Oil	92	19,040	62,030		12		23
66	Great Round Shoal, Mass.	2	590	1895	Comp.	123	0	28	0	12" steam whistle	Acet.	4,686	20,404	60,282		12		
73	Pallack Rip Shoal, Mass.	2	538	1901	Steel	125	0	28	0	do	Oil	139	19,247	79,872		12		
85	Nantucket Shoals, Mass.	2	1,083	1907	do	135	0	29	0	do	Oil	1,049	29,789	98,000		9		14
86	Relief	2	1,483	1907	do	135	0	29	0	do	Oil	2,145	18,689	99,000		6		7
90	Relief	2	685	1908	do	135	0	29	0	do	do	3,834	22,045	107,213		4		16
11	Scotland, N. J.	3	320	1853	Wood	104	0	24	8	Bell	Acet.	239	10,110	13,462		11		12
13	Barlett Reef, Conn.	3	155	1871	do	179	8	21	8	10" air whistle	do	880	13,578	12,000		11		8
16	Relief	3	250	1854	do	103	6	22	6	First-class air siren	do	5,007	6,551	28,084		6		15
23	Ram Island Reef, Conn.	3	186	1877	do	194	2	24	0	10" whistle	do	5,107	9,380	7,500		11		
39	Brenton Reef, R. I.	3	387	1875	do	119	6	25	9	10" and 6" air whistle	Oil	2,618	16,524	42,200		10		
44	Northeast End, N. J.	3	197	1882	Iron	115	6	25	0	First-class steam siren	Acet.	499	15,475	50,000		11		7
48	Cornfield Point, Conn.	3	1,470	1891	Comp.	120	10	27	8	First-class air siren	Acet. and oil	1,102	14,092	52,780		10		20
68	Fire Island, N. Y.	3	1,580	1897	do	122	10	28	6	12" steam whistle	Acet.	3,907	23,042	74,750		10		
69	Overfalls, Del.	3	1,500	1897	do	122	10	29	6	do	do	1,634	19,249	79,500		9		30
78	Relief	3	1,068	1888	Steel	129	0	28	6	10" steam whistle	do	727	20,249	89,033		8		11
79	Five-Fathom Bank, N. J.	3	1,608	1904	do	129	0	28	6	steam siren and bell	Oil	3,437	22,950	89,000		9		24
87	Ambrose Channel, N. Y.	3	1,683	1907	do	135	5	29	0	12" steam whistle	Oil	6,891	21,748	99,000		9		27
2	Relief	5	210	1849	Wood	98	0	25	0	Bell	do	667	5,023	12,402				
45	Thirty-Five Foot Channel, Va.	5	1,401	1887	Steel	124	6	27	6	8" air whistle	do			58,500				

TENDERS OF LIGHTHOUSE SERVICE IN COMMISSION DURING THE FISCAL YEAR 1920.

Name	Propulsion		Dimensions					Mean draft		Regular complement		Miles steamed	Fuel consumed for all purposes	Cost of repairs	Cost of maintenance	Original cost					
	Type	Horsepower	Length over all	Breadth	Depth	Light	Loaded	Officers	Crew												
Flamingo	1	818	1,084	1908	Steamer, twin screw	Steel	190	30	16	11	0	13	3	1,000	7	27	11,837	1,874	\$11,493	\$74,621	\$181,643
Zephyrus	1	325	441	1888	do	Iron	161	27	12	8	9	9	6	650	6	22	11,263	1,117	24,243	56,406	48,739
Aurora	2	818	1,063	1908	do	Steel	190	30	16	11	0	13	0	1,000	7	26	14,840	1,744	4,420	68,644	191,000
Aurora	2	330	510	1891	Steamer, single screw	do	154	25	12	6	6	9	0	400	6	22	8,700	897	5,784	48,940	79,792
Maximilian	2	630	608	1897	Steamer, twin screw	do	164	30	12	7	9	8	1	650	6	24	7,380	1,217	4,492	60,346	74,872
Shelby	2	362	455	1912	Steamer, single screw	Wood	196	29	13	6	5	9	9	300	2	13			470	1,370	
Pausanias	3	61	81	1892	do	do	80	14	5	4	0	5	0	60	2	5	5,236	132	696	10,547	0,500
Gardner	3	217	246	1879	do	do	117	20	9	6	0	6	6	200							
John Rodgers	3	454	571	1883	Steamer, side wheel	Iron	160	27	9	6	6	7	9	260	4	17	4,397	492	1,987	33,949	59,987
Larkspur	3	738	888	1903	Steamer, twin screw	Steel	190	30	14	9	1	10	6	750	7	25	12,587	2,105	3,411	58,966	123,259
Masthead	3	455	476	1872	Steamer, side wheel	Wood	160	26	9	6	9	7	0	370	4	16	5,397	531	765	33,646	45,833
Pansy	3	431	454	1878	Steamer, twin screw	Iron	152	25	11	7	7	11	250	4	17	7,572	886	3,807	37,517	48,739	
Thetis	3	774	1,142	1908	do	Steel	190	30	16	10	7	13	9	1,000	7	27	16,040	2,121	8,785	62,050	191,648
Myrtle	3	435	512	1872	Steamer, single screw	Wood	140	25	11	9	6	11	0	225	4	16	13,496	842	2,681	36,046	44,000
Elm	3	259	318	1918	Oil, single screw	do	101	30	9	5	6	6	9	150	2	4	1,242	63,447	5,115	15,685	93,638
Pine	3	55	56	1918	Gasoline, single screw	do	61	15	6	4	3	4	4	50	2	3	3,461	63,413	908	8,958	16,187
Iris	4	519	606	1897	Steamer, single screw	Steel	153	30	10	8	7	9	6	800	5	20	8,223	1,198	1,833	45,349	84,407
Woodbine	4	85	107	1913	Gasoline, single screw	Wood	95	16	7	5	2	5	11	125	2	5	5,617	611,237	57	11,518	24,728
Columbine	5	429	643	1892	Steamer, single screw	Steel	155	27	15	9	6	12	3	800	7	24	8,155	801	2,120	54,864	58,238
Arbutus	5	398	545	1879	Steamer, twin screw	Wood	153	25	11	7	1	9	0	360	7	22	11,308	1,058	3,033	54,022	49,789
Holly	5	431	499	1881	Steamer, side wheel	Comp	176	24	10	7	0	8	6	400	5	18	10,839	921	1,402	44,430	41,911
Jessamine	5	369	403	1881	do	Iron	156	24	10	7	3	7	9	350	4	18	7,546	720	2,935	40,364	41,911
Juniper	5	425	446	1893	Steamer, twin screw	Steel	95	18	8	4	6	5	0	200	2	10	5,873	422	17,454	21,303	29,425
Laurel	5	218	299	1915	Steamer, single screw	Wood	105	22	9	6	1	6	10	160	4	12	9,863	423	9,051	30,812	55,502
Maple	5	567	799	1893	Steamer, twin screw	Steel	164	30	12	7	3	9	5	650	7	24	10,812	1,550	32,081	53,920	93,889
Orchid	5	818	1,081	1908	do	do	190	30	16	11	0	13	3	1,000	7	28	12,795	1,609	11,437	64,277	186,151
Cypress	6	790	1,080	1908	do	do	190	30	16	10	9	13	3	1,000	7	28	14,400	2,000	2,751	73,553	191,633
Mangrove	6	606	821	1897	do	do	164	30	12	7	4	8	0	550	7	24	6,405	913	180,873	41,599	74,998

Palmetto.	6	156	170	1917	Gasoline, twin screw.	do.	90	22	8	3	8	4	0	150	4	8	4,615	11,000	7,687	23,388	27,687
Water Lily.	6	29	39	1895	do.	Wood.	64	11	5	2	11	3	8	36	2	3	4,912	63,073	591	9,624	9,261
Ivy.	7	736	916	1904	Steamer, twin screw.	Steel.	173	30	13	8	5	9	6	700	7	24	8,024	1,531	2,401	69,943	123,860
Snowdrop.	7	30	41	1896	Gasoline, twin screw.	Wood.	60	11	5	2	10	3	7	32	2	2	4,040	63,415	1,344	9,070	9,700
Poinsettia.	7	27	31	1915	Gasoline, single screw.	do.	50	16	6	2	5	2	9	50	2	2	5,401	65,272	1,008	9,440	
Camellia.	8	276	377	1911	Steamer, twin screw.	Steel.	117	24	10	5	10	7	7	280	4	17	5,546	682	1,790	36,943	57,412
Magnolia.	8	685	877	1904	do.	do.	173	30	13	7	6	9	2	700	7	25	11,294	1,904	25,876	60,337	124,874
Sunflower.	8	896	1,246	1907	do.	do.	174	31	15	9	8	12	2	900	7	27	7,615	1,723	3,371	70,574	124,958
Cosmos.	8	57	61	1903	Gasoline, twin screw.	Wood.	75	15	6	3	9	4	0	100	1	4	1,480	62,505	5,199	9,994	
Lilac.	9	542	582	1892	Steamer, single screw.	Steel.	155	27	15	11	0	11	6	800	6	20	6,468	735	4,332	56,317	92,125
Crocus.	10	681	1,035	1901	Steamer, twin screw.	do.	165	29	14	9	6	12	3	700	5	23	7,308	1,538	3,647	48,578	119,718
Ananthur.	11	597	975	1892	Steamer, single screw.	do.	166	28	14	8	6	12	6	672	5	20	10,769	1,100	47,887	46,209	74,994
Aspen.	11	353	415	1886	do.	do.	126	25	12	7	3	8	3	440	4	10	5,904	745	3,595	26,146	70,573
Clover.	11	163	205	1899	do.	Wood.	93	22	7	5	4	6	4	110	4	8	9,255	462	311	21,642	
Marigold.	11	477	686	1890	do.	Iron.	180	27	12	8	5	11	0	550	6	20	9,789	1,001	5,311	44,410	84,871
Hymenanth.	12	493	914	1903	do.	Steel.	165	28	14	7	0	11	6	768	6	20	10,435	1,547	5,781	50,391	115,000
Sumac.	12	600	887	1893	Steamer, twin screw.	do.	169	30	13	8	10	11	9	700	6	23	9,362	1,549	1,723	51,479	114,992
Pandelion.	13	232	302	1893	Steamer, stern wheel.	Wood.	140	31	5	2	6	3	3	500	4	15	5,542	1,295	2,618	26,394	23,174
Goldthread.	14	194	283	1888	do.	Steel.	169	27	4	2	5	3	4	152	2	12	6,788	660	1,117	22,995	33,221
Oleander.	15	463	548	1903	do.	do.	189	34	7	3	10	4	6	600	4	17	9,947	2,053	9,217	38,369	60,000
Fern.	16	245	317	1915	Steamer, single screw.	Wood.	112	22	10	7	1	8	6	300	5	11	12,057	2,509	11,384	40,438	62,100
Cedar.	16	1,245	1,970	1917	do.	Steel.	201	36	18	9	6	14	0	1,150	8	25	17,249	14,600	19,677	102,947	248,189
Heather.	17	631	831	1903	do.	do.	179	28	15	9	6	11	6	685	7	19	9,516	1,716	2,045	54,734	118,568
Manzanilla.	17	774	1,000	1908	Steamer, twin screw.	do.	190	30	16	10	7	12	7	1,000	7	23	7,840	1,962	4,176	62,983	211,817
Rose.	17	395	567	1916	do.	do.	127	24	11	7	0	9	4	330	5	16	10,913	324	3,235	49,750	92,135
Madroño.	18	654	806	1885	Steamer, single screw.	Iron.	180	27	15	9	9	11	6	750	7	21	7,974	1,429	3,020	59,170	87,872
Sequoia.	18	809	1,100	1908	Steamer, twin screw.	Steel.	190	30	16	10	11	13	5	1,000	7	24	10,767	1,527	5,258	67,575	213,499
Kukui.	19	838	935	1908	do.	do.	190	30	16	11	2	12	0	1,000	7	24	8,824	1,424	3,136	75,805	213,880

Equipped with radio.

1 Light without cargo and deck loads, and a minimum supply of stores, provisions, water, and coal or oil.

2 Loaded with bunkers or fuel-oil tanks full of coal or oil, all tanks, including trimming tanks, full of water; full stores and provisions, and an average maximum cargo and deck load.

3 Laid up, under reconstruction. Placed in commission July 31, 1920.

4 Condemned and sold Sept. 19, 1919.

5 Length between perpendiculars.

6 Gallons gasoline.

7 Displacement (fresh water).

8 Barrels of fuel oil. 1 barrel—12 gallons.

LIGHTHOUSE VESSELS SOLD DURING THE FISCAL YEAR 1920.

Light Vessel No. 45, formerly stationed on Thirty-Five Foot Channel Station, Va., in the lower Chesapeake Bay, fifth lighthouse district, and badly damaged by fire while in a shipyard for repairs, was surveyed and condemned as unserviceable and beyond economical repair, and of no further use to the Service, and sold on April 27, 1920, to the highest bidder for \$2,113.

Light Vessel No. 97, formerly stationed at Bush Bluff, Elizabeth River, Va., fifth lighthouse district, near Norfolk, was surveyed and condemned as unserviceable and of no further use to the Service, and sold on April 27, 1920, to the highest bidder for \$150.

Light Vessel No. 43, *Relief*, attached to the eighth lighthouse district, was surveyed and condemned as unserviceable, and of no further use to the Service, and sold on June 17, 1920, for \$5,300.

The tender *Gardenia*, formerly attached to the third lighthouse district, was surveyed and condemned as unserviceable, and of no further use to the Service, and sold on September 19, 1919, to the highest bidder for \$1,065.

All serviceable equipment was removed from these vessels prior to their sale and reserved for further use on other vessels of the Service as may be needed.

CONSTRUCTION OF TENDERS AND LIGHT VESSELS.

Tender "Aster" and barge.—The act of July 1, 1916, appropriated \$20,000 for constructing or purchasing and equipping a small tender and barge for the eighth district, Texas and Louisiana. It was proposed to purchase a suitable vessel for a tender and construct the barge from plans and specifications now in preparation. Bids were twice invited for the purchase of a suitable tender without satisfactory results, as no suitable vessel could be found.

Plans and specifications were prepared for a suitable tender and bids again invited. The bids received exceeded the appropriation and were rejected. The specifications have been modified and bids will again be invited in the near future. Amount expended to June 30, 1920, \$23.64.

Tender.—The act of June 12, 1917, appropriated \$150,000 for a lighthouse tender for the third district to replace the tender *Gardenia* or for general service.

Specifications were prepared and bids invited for the construction of the vessel. The lowest bid received being greatly in excess of the appropriations, all were rejected. Bids were again invited on August 1, 1919, after extensive advertisement. The lowest bid received was again greatly in excess of the appropriation, and all bids were rejected. It is proposed to construct a smaller tender from this appropriation as soon as plans and specifications are prepared. Amount expended to June 30, 1920, \$177.41.

Tenders "Oak" and "Hawthorn."—The act of November 4, 1919, appropriated \$760,000 for tenders and light vessels. Plans and specifications were prepared and bids received for the construction of two tenders, or one tender and one light vessel. The lowest bids received were \$357,250 for a tender and \$396,750 for a light vessel. Due to the urgent need for tenders, contracts were on December 13, 1919, awarded to the Consolidated Shipbuilding Corporation, Morris Heights, N. Y., in the total sum of \$714,500 for two tenders. The two tenders were approximately 9 per cent complete June 30, 1920. Amount expended to June 30, 1920, \$952.94.

Light Vessel "No. 99."—The act of August 24, 1912, appropriated \$130,000 for a light vessel for general service. Plans and specifications were prepared for a light vessel for the Great Lakes. Bids were received on May 25, 1916, and, on June 29, 1916, a contract was awarded to Rice Bros., East Boothbay, Me., in the sum of \$61,000. The construction of the vessel had reached a degree of completion of approximately 54 per cent, when, on July 10, 1917, a disastrous fire occurred at the builders' plant in which the vessel and the greater part of its fittings were rendered a total loss.

The contractors took prompt steps to procure new material, and the construction of a new vessel, a duplicate of the one destroyed, was commenced, but owing to labor troubles and other causes the work has progressed slowly. The work was approximately 93 per cent complete on June 30, 1920. Amount expended to June 30, 1920, \$87,058.56.

Light Vessel "No. 100."—Plans and specifications are in preparation for a large light vessel for station at Nantucket Shoals, Mass. There is a balance of approximately \$51,600 remaining under the appropriation of August 26, 1912, for light vessels, but the construction of this vessel from the available balance will not be possible until additional funds are available to meet the higher costs of production caused by the present abnormal conditions. Estimates have been prepared and submitted, and it is now proposed to construct this vessel from the plans and specifications prepared for

Light Vessel No. 105, when an appropriation is made by Congress under the general authorization of June 5, 1920.

Light Vessels "No. 103" and "No. 104."—The act of June 12, 1917, appropriated \$150,000 for light vessels for general lake service. Plans and specifications for two vessels similar in construction to Light Vessel No. 99 have been completed. Bids were received for the construction of one or both vessels, on January 15, 1918, and on June 5, 1918, a contract was awarded to the Gas Engine & Power Co. and the Charles L. Seabury Co., Morris Heights, N. Y., in the sum of \$147,428 for the construction of one vessel, No. 103. It is proposed to invite new bids for Light Vessel No. 104 when funds are available, estimates for which have been prepared and submitted. The construction of Light Vessel No. 103 was approximately 82 per cent complete on June 30, 1920. Amount expended up to June 30, 1920, \$90,399.02

Light Vessel "No. 105."—The act of November 4, 1919, appropriated \$450,000 for the construction of a light vessel for Diamond Shoal Light Vessel Station, N. C., to replace Light Vessel No. 71 which was sunk by a German submarine on August 6, 1918. Plans and specifications were prepared and bids received for the construction of the vessel. A contract was on December 31, 1919, awarded to the Consolidated Shipbuilding Corporation, Morris Heights, N. Y., in the sum of \$396,750. The vessel was approximately 2 per cent complete on June 30, 1920. Amount expended to June 30, 1920, \$324.12.

Light vessel "No. 106" (Cape Charles).—The act of June 12, 1917, appropriated \$130,000 for a light vessel for Cape Charles, Va., or for general service. Plans and specifications were prepared and bids invited for the construction of the vessel. The lowest bid received was greatly in excess of the appropriation and all bids were rejected. It is proposed to invite bids for a smaller light vessel for duty on the Great Lakes, similar to light vessels No. 99 and No. 103, now under construction, when prices are more normal, which it is hoped may occur in the near future. It is also proposed to construct light vessel No. 106 from plans and specifications prepared for light vessel No. 105 when an appropriation is made by Congress covering the authorization made by the act of June 5, 1920, for constructing or purchasing and equipping lighthouse tenders and light vessels for the Lighthouse Service, \$5,000,000.

Radio equipment for lighthouse vessels.—The act of June 12, 1917, appropriated \$60,000 for installing radio equipment on lighthouse tenders, seven tenders having been previously so equipped. This amount has not been expended, the Navy Department having used naval appropriations for the equipment of 16 tenders with radio during the war. In all, 27 tenders were equipped with radio at the end of the fiscal year 1920. The appropriation of June 12, 1917, will be used to equip other tenders with radio apparatus as soon as practicable. Amount expended to June 30, 1920, \$24,569.15.

The installation of radio on light vessels is in progress. At the end of the fiscal year 42 light vessels had been equipped with radio apparatus. One vessel was equipped during the fiscal year 1920, and the radio equipment on another vessel was removed. This work has been done by the Navy Department in cooperation with the Lighthouse Service and was paid for with funds from naval appropriations.

SPECIAL WORKS OF CONSTRUCTION COMPLETED (OMITTING VESSELS).

FIRST DISTRICT.

Repairing and rebuilding aids to navigation, Atlantic coast.—The act of November 4, 1918, appropriated \$300,000 for rebuilding, repairing, and establishing aids damaged by storms and ice, from which an allotment of \$3,937 was made to the first district. The objects and amounts expended to June 30, 1920, are as follows: Stones Rock Beacon, Me., new daymark, established July 21, 1919, at a cost of \$31.27; Eastern Egg Rock Beacon, Me., rebuilding tripod established August 30, 1919, at a cost of \$351; Ash Island Beacon, Me., rebuilding tripod established August 25, 1919, at a cost of \$324; Cape Neddick Light Station, Me., repairs to boatslip, completed July 28, 1919, at a cost of \$58.89; Little Diamond Island Lighthouse Depot, Me., repairing wharf, 43 new posts and piles, reinforcing 13 bearing piles with cement, completed October 31, 1919, at a cost of \$727.13; and Channel Rock Beacon, Pleasant River, Me., a new spindle, 35 feet tall, with daymark and braces, was put up and protected with riprap, established September 17, 1919, at a cost of \$1,050.77.

THIRD DISTRICT.

Staten Island Lighthouse Depot, N. Y.—The act of June 12, 1917, appropriated \$21,000 for improving the office and laboratory at the General Lighthouse Depot. The erection of the new office building resulted in the joining together into one

structure of the three buildings previously used as offices, thereby adding considerably to the floor space and to the efficiency of the office. The work was started in November, 1918, and completed in March, 1920. Amount expended to June 30, 1920, \$19,663.65.

Ambrose Channel lighted buoys, N. Y.—The act of July 1, 1918, appropriated \$26,000 for improving the system of lighted buoys in Ambrose Channel, N. Y. The plan of general changes consisted of the substitution of L-type acetylene buoys for the C-type mantle oil-gas buoys then in use, which were unreliable on account of mantles being frequently broken, causing the lights to become extinguished. The work was started in June, 1919, and completed in April, 1920. Amount expended to June 30, 1920, \$25,743.80.

FOURTH DISTRICT.

Aids to navigation, Delaware River, Pa. and Del.—The act of March 3, 1915, authorized this work. The act of July 1, 1916, appropriated \$80,000. From this appropriation the following aids were built, and are now in operation:

Chester Range Front Light Station, Pa.—A flashing automatic acetylene light, shown from a 50-foot structural-steel tower erected on a foundation crib in the Delaware River in 13 feet of water. Station is protected by riprap.

Chester Range Rear Light Station, Pa.—A fixed white automatic acetylene light, shown from a 100-foot structural-steel tower on concrete piers, supported by timber grillage. On the north side of Crum Creek, Pa.

Marcus Hook Range Front Light Station, Del.—A flashing white automatic acetylene light, shown from a 72-foot structural-steel tower, supported on a concrete block on a pile foundation in the Delaware River at low-water mark.

Marcus Hook Range Rear Light Station, Del.—A fixed incandescent oil vapor light shown from a 100-foot detached concrete tower with brick dwelling alongside. At Gordon Heights, Del., $1\frac{1}{4}$ miles in rear of front light.

Fort Mifflin Fog Signal, Pa.—The bell signal at this station was replaced by an electric siren located on a steel post at the outer end of lower pier at Fort Mifflin, Pa.

Amount expended to June 30, 1920 (no known obligations outstanding), \$79,937.80.

FIFTH DISTRICT.

Aids to navigation Cape Charles City, Va.—The act of June 12, 1917, appropriated \$12,800 for improving lights and fog signals leading to Cape Charles City, Va. A cast-iron caisson 12 feet in diameter filled with concrete with steel shell cutting edge and top flared out to 14 feet in diameter was put down by contract on Cherrystone Bar, about three-fourths mile south of the entrance to Cape Charles City. On this foundation was erected a pyramidal steel pipe tower surmounted by steel lamp stand and an oil-burning lens lantern. The light was established October 1, 1919. The amount expended from the special appropriation to June 30, 1920, was \$12,646.69. The light was improved on January 15, 1920, by the installation of 300 mm. unwatched acetylene flashing light. The station was further improved on June 1, 1920, by the installation on the structure of an automatic fog bell actuated by carbon-dioxide gas stored in cylinders. Protective works of riprap stone were placed surrounding the caisson during construction. The amount spent from appropriation G. E. L. H. S., 1920, for improvements and protection of site was \$5,105.29. Amount spent from the special appropriation to June 30, 1920, \$12,646.69.

EIGHTH DISTRICT.

Aransas Pass Light Station, Tex.—The act of October 6, 1917, appropriated \$20,000 for repairing and rebuilding dwellings, outbuildings and appurtenant structures damaged or destroyed in the hurricane of August 18, 1916. During the fiscal year 1918 the contract was awarded for building a dwelling, oil house, T wharf, walks, etc. The contractor commenced work at the station during May, 1918, and practically completed all work in September, 1919, except furnishing some hardware which was delivered and final payment was made in December, 1919. The dwelling is an elevated hollow-tile and stucco structure for two keepers near site of former dwelling. Amount expended to June 30, 1920, \$19,940.95.

Galveston Jetty Light and Fog Signal Station, Tex.—The act of June 11, 1896, appropriated \$35,000, and the act of May 27, 1908, \$10,000 for establishing a light and fog-signal station at or near the outer end of one of the jetties at Galveston Harbor, Tex.

There was a very long delay in commencing the work, due to the selection of a proper site, and to the fact that after the site was selected and work started the jetty was extended. Finally it was decided to build on the original site, and work was continued.

Great damage was done the uncompleted structure by the hurricane of August 16-17, 1915, which destroyed the construction wharf, bent the framework of the structure, and washed away much material. Subsequently materials were again assembled, another wharf erected, and the framework straightened. The construction work was again washed away in the hurricane of August 18, 1916, and some of the lower struts of the substructure were again bent. A portion of the lens for this station was lost in the hurricane of July 5-6, 1916, one box containing parts of same having been washed away from the Mobile Lighthouse Depot. In March, 1917, the installation of intermediate beams to reinforce struts was completed. A concrete block 49 feet square around foundation piles, and in places $5\frac{1}{2}$ to 15 feet in depth, on northerly and southerly edges, was completed during the fiscal year 1918, and the illuminating apparatus was installed. The light was exhibited November 12, 1918. The structure is completed and a temporary fog bell struck by machinery will be installed at an early date, pending the establishment of a more powerful fog signal as soon as funds are available therefor, and for which estimate has been submitted. Amount expended to June 30, 1920, \$44,901.13.

TENTH DISTRICT.

Huron Harbor, Ohio.—The act of June 12, 1917, appropriated \$4,500 for establishing aids to navigation at Huron Harbor, Ohio. A steel tower was erected on a concrete foundation, and an electric light placed in commission on August 29, 1919. Amount expended to June 30, 1920, \$4,092.42.

TWELFTH DISTRICT.

White Shoal, Mich.—The act of March 4, 1907, appropriated \$250,000 for a light and fog signal station at White Shoal, Mich., in the north end of Lake Michigan, to replace the White Shoal Light Vessel. The tower was completed and the light placed in commission September 1, 1910, and the fog signal on September 15, 1910. A submarine bell was established September 20, 1911, and later discontinued. A water-supply system was installed in October, 1911, and an oil-supply system in June, 1913. Riprap was placed about the station in August, 1914, and an auxiliary acetylene light for winter service was established in December of the same year. Air hoists were placed on the three boat cranes in October, 1919, at a cost of \$1,677.38, out of an allotment of \$1,900 from the special appropriation. An additional motor boat for the station was secured from the Navy Department in June, 1920, and paid for by a transfer of funds, \$1,677.38, from the special appropriation. The entire project has now been completed. Amount expended to June 30, 1920, \$226,858.95.

Manitowoc Breakwater, Wis.—The act of June 12, 1917, appropriated \$21,000 for improving the light and fog signal station at Manitowoc, Wis. The sundry civil act, approved July 19, 1919, appropriated \$9,000 additional for completing the above project, this being made necessary by the advance in costs. The old frame structure and steam fog signal and oil light have been removed. A new light and fog signal building has been constructed on the outer end of North Breakwater, having a reinforced concrete foundation pier and basement and steel plate superstructure lined with hollow tile. Electric and oil engine driven compressors and diaphone fog signal and electric light have been installed. A steel switch house has been built at shore end of breakwater and connected with fog signal by electric cable along breakwater. Temporary light established in structure, November 15, 1918. Permanent electric light established, December 13, 1919. And diaphone fog signal established, December 13, 1919. The entire project has been completed; amount expended to June 30, 1920, \$27,209.96.

SPECIAL WORKS OF CONSTRUCTION UNCOMPLETED (OMITTING VESSELS).

FIRST DISTRICT.

Repairing and rebuilding aids to navigation, Atlantic coast.—The act of November 4, 1918, appropriated \$300,000 for rebuilding, repairing, and reestablishing aids damaged by storm and ice, from which an allotment of \$3,937 was made the first district. Works were under way at the close of the fiscal year.

The Boilers Beacon, Sasanoa River, Me.—Work of removing broken spindle and replacing it with new spindle and day mark was commenced.

Carleton Ledges Jetty Beacon, Sasanoa River, Me.—Work of repairing the spindle was in progress.

Lime Rock Beacon, Me.—The work of renewing the iron spindle carried away by the ice was in progress.

Amount expended to June 30, 1920, \$2,983.35.

SECOND DISTRICT.

Woods Hole, Mass., Lighthouse Depot.—The act of July 1, 1916, appropriated \$50,000 for improvements at Woods Hole (Mass.) depot. About 3,200 feet of channel leading to the depot, 150 feet wide were dredged to a depth of 17 feet; the basin, about 550 feet by 400 feet, was dredged to the same depth. A two-story storehouse, 35 feet by 80 feet, of brick, with steel frame and reinforced concrete floors and roof, was finished by contract August 18, 1917. Electric light and electric welding equipments have been installed, and the roof and outside walls of the carpenter shop are to be recovered with asbestos shingles. Amount expended to June 30, 1920, \$49,582.86.

Nantucket Harbor Fog Signal, Mass.—By act of July 1, 1918, the appropriation of \$15,000 contained in act of March 28, 1918, for a fog-signal whistle was made available for establishing an electrically operated fog bell on the east breakwater at Nantucket Harbor, Mass. The fog-signal tower has been completed and the bell and striker installed. The submarine cable has been purchased and laid, and the generating apparatus in duplicate has been purchased and installed in the old tower at Brant Point. A spare motor for fog bell striker has been purchased, and bids have been invited for spare cable. The fog signal went into operation November 1, 1919. Amount expended to June 30, 1920, \$8,657.70.

Depot for second lighthouse district.—By act of July 1, 1918, \$85,000 was appropriated for building a depot at Chelsea, Mass. The old wharf at the site has been rebuilt by contract at a cost of \$12,495, and the work was completed in November, 1919. A contract has been made for building a three-story storehouse with basement, 35 feet by 80 feet, of concrete foundation, brick walls, steel frame, and reinforced concrete floors and roof. The basement walls and pier footings have been built and a part of the steel frame erected. Amount expended to June 30, 1920, \$13,082.07.

Light keepers' dwellings.—By act approved July 19, 1919, \$50,000 was appropriated for light keepers' dwellings, and \$11,000 was allotted the second lighthouse district for assistant keepers' dwellings at Brant Point Light Station and Wings Neck Light Station. Bids were invited for building a small six room, cement plastered dwelling at both stations, but were rejected owing to excessive prices. The erection of these buildings will be held in abeyance awaiting an increase in the limit of cost fixed for each dwelling, or more favorable business conditions. Amount expended to June 30, 1920, \$34.23.

THIRD DISTRICT.

Aids to navigation, Hudson River, N. Y.—The act of July 1, 1916, appropriated \$100,000 for improving aids to navigation and the establishment of new aids on the Hudson River, N. Y. The work of improving, rebuilding, and establishment of the aids will affect 21 different points. The work accomplished up to the present consists of the building and equipping a barge for the purpose of erecting the lights, the establishment of two new lights, and changing 16 old lights from oil to acetylene. The changes in illuminant and the establishment of the three remaining lights is held up awaiting the purchase of sites, land grants, etc. The towers have all been built and illuminating apparatus purchased ready to be installed. The project was started in December, 1916, and it is expected will be completed about November, 1920. Amount expended to June 30, 1920, \$98,713.94.

Great Salt Pond Light Station, R. I.—The act of June 12, 1917, appropriated \$20,000 for building a new dwelling and moving the fog signal from the inner to the outer end of the breakwater. Plans for dwelling are completed, cession of land and jurisdiction over same has been received from the State of Rhode Island. The necessary riprap has been placed and the settling of same is awaited before erecting structure. Owing to increase in the cost of labor and material, and to change in location of the light to the extreme end of the breakwater, to make the harbor convenient as a base for naval vessels, an additional appropriation is required to complete this work. The estimated additional amount required is \$53,000. Work was started in May, 1919, and it is expected will be completed about September 15, 1921, if funds are available. Amount expended to June 30, 1920, \$18,703.55.

Staten Island Lighthouse Depot, N. Y.—The act of March 28, 1918, appropriated \$60,000 for repairing the wharves of the General Lighthouse Depot, Tompkinsville, N. Y. It is proposed to remove the old wooden decks, furnish and install additional steel work, cast-iron pile columns, manhole frames, covers and pipe hangers, and place new concrete decks on the wharves. On account of the incessant use of wharves it has been necessary to do this work in three sections, one at a time. The work on the south wharf was started in September, 1918, and completed in February, 1919. The work on the north wharf was started in July, 1919, and completed in November, 1919. It is expected the balance of the work will be completed about December 30, 1920. Amount expended to June 30, 1920, \$56,879.12.

Plate shop, coal shed, etc., General Lighthouse Depot, N. Y.—In August, 1918, an allotment of \$175,000 was made from funds for national security and defense, to carry out certain necessary alterations and provide certain necessary equipment at the General Lighthouse Depot, Tompkinsville, N. Y. These consisted of the removal of the old coal shed, the erection of a new coal shed, and erection of two temporary coal bins for use while the new coal shed was being built, and to erect on the site of the old coal shed an extension to the present blacksmith shop to be used as a boiler and plate shop. Temporary coal bins were erected, the old coal shed was torn down, the extension to the blacksmith shop was made, and a new iron rack built to replace one removed. About 65 per cent of the work on the new coal pocket has been completed, and it is expected the entire project will be finished about September 15, 1920. Amount expended to June 30, 1920, \$113,439.97.

Execution Rocks Light Station, N. Y.—The act of July 19, 1919, appropriated \$10,000 for restoring and improving the light station, which had been damaged by fire. Work of building new engine house and repairing dwelling was commenced in June, 1920, and will be completed about November 1, 1920. Total amount expended to June 30, 1920, \$596.90.

Staten Island Lighthouse Depot, N. Y.—The act of July 19, 1919, appropriated \$30,000 for extending and enlarging the machine shop at the General Lighthouse Depot, Tompkinsville, N. Y. The present machine shop as constructed is not well adapted to the work which is done in it. It will have to be extended and enlarged before it can be made an efficient and economical shop. The advance in building costs since original estimate of \$45,000 was made will necessitate the authorization of \$30,000 additional, or a total of \$60,000, for this work. Plans have been prepared and bids will be invited as soon as additional funds are available. It is expected that this work will be started about March, 1921, and completed about November 15, 1921. No expenditures made from this appropriation to June 30, 1920.

Riprap protection for light stations.—The act of July 19, 1919, appropriated \$150,000 for riprap to reinforce foundations and protect them from damage by sea and ice, and to construct and improve boat landings at various light stations in the third lighthouse district. The total estimated cost of this work was \$283,775, but on account of the advance in prices of riprap it has been found necessary to increase the estimate of cost to \$340,520. The light stations at which this riprap is to be deposited are practically all on submarine sites, and those not so located are subject to damage from the sea. Contract has been let and riprap is now being placed at Colchester Reef Light Station, Lake Champlain, to protect and strengthen the foundation from further damage. Bids were invited for furnishing and placing riprap at several other light stations but were rejected on account of the excessive cost. Two lighters have recently been purchased from the War Department for \$4,500 each, for the purpose of placing the riprap by hired labor, and work will be commenced as soon as necessary machinery can be procured for the lighters. Work was started in August, 1919, and it is expected will be completed about August, 1922. Total amount expended to June 30, 1920, \$60.72.

Hunts Point, N. Y.—The act of March 4, 1911, appropriated \$5,000 for the establishment of a light and fog signal to mark Hunts Point, between Hell Gate and White-stone Point, East River, N. Y. The work of erecting a structure for the light and fog signal was started in November, 1916, and the light went into commission on January 4, 1917. The structure consists of a steel tower built on a stone and concrete foundation with necessary provision for the establishment of a fog signal later on, when it is practicable to procure electric current for its operation. The date of the completion of this project is indefinite, but it is possible that current will be obtained and the fog signal be in operation by October, 1920. Amount expended to June 30, 1920, \$3,520.21.

Aids to navigation, East River, N. Y.—The act of June 12, 1917, appropriated \$16,000 for improving the aids to navigation in the East River, N. Y. Up to the present time the work done consists in the establishment of one new light, the rebuilding of the light structures and change of illuminant from oil to acetylene of three existing lights, the discontinuance of one of the lights, and the removal to a new location of one of the oil lights. The work yet to be done consists in the change of illuminant of one of the lights from oil to electricity. The work was started in September, 1917, and it is expected will be completed in September, 1920. Amount expended to June 30, 1920, \$15,943.89.

FOURTH DISTRICT.

Joe Flogger Shoal, Del.—The act approved July 1, 1918, provided that the unexpended balance of the appropriation of \$40,000 "toward a light and fog-signal station on the Joe Flogger Shoal, Delaware River," contained in the act approved June 30, 1906, be made available for establishing gas buoys and improving aids to navigation in the vicinity of Joe Flogger Shoal, Del.

Under this authorization five modern gas buoys have been manufactured and delivered and the lighting of this shoal materially improved. Spare buoys of modern type and spare equipment have been ordered and are now being manufactured. All work contemplated under this appropriation is expected to be completed during the fiscal year 1921.

Amount expended to June 30, 1920, \$19,701.72.

FIFTH DISTRICT.

Aids to navigation, Chesapeake Bay, Md. and Va.—The act of June 12, 1917, appropriated \$29,000 for aids to navigation on the Eastern Shore of the Chesapeake Bay and tributaries. Four type S buoys, one for the Susquehanna River and three for the Eastern Shore, Md., have been delivered. Amount expended to June 30, 1920, \$5,993.55.

Repairing and rebuilding aids to navigation, Atlantic coast.—The act of March 28, 1918, appropriated \$150,000 for rebuilding, repairing, and reestablishing aids damaged by storm and ice, from which \$100,000 was allotted to the fifth district. The act of November 16, 1918, appropriated \$300,000 additional for the same purpose, from which \$284,000 was allotted the fifth district. The restoration of light stations in the fifth district damaged by ice floes during the winter of 1917-18 was continued during the past fiscal year by depositing riprap at nine light stations, building up existing protective works near or around these stations, or constructing new barriers or ice breakers, and by constructing new foundations and inserting bracing under several screw pile lighthouses, as follows: At Tangier Sound Light Station, Chesapeake Bay, Va., a new concrete foundation on wood piles in the form of a hollow square encasing the existing screw piles, was constructed. The station was further protected from scour and ice action by the deposit of 1,000 tons of riprap stone. At Windmill Point Light Station, Chesapeake Bay, Va., 800 tons of riprap stone were placed on the north side of the station in the form of an ice breaker to protect the weakened structure from ice floes coming down on it on the ebb tide. At Thomas Point Light Station, Chesapeake Bay, Md., the existing ice breakers on the north and south sides of the station were built up by the addition of 600 tons of riprap stone to withstand the impact of drifting ice fields.

At Point Lookout Light Station, Potomac River, Md., 600 tons of stone were deposited on the existing shore protection works to restore same to original level. This work was then extended to prevent encroachment of the seas on the reservation. At Cedar Point Light Station, Chesapeake Bay, Md., 1,000 tons of riprap stone were placed on the existing protective works on the southeast side, and at other places around the station, to protect the same from ice and storms. The concrete seawall surrounding the station would be undermined by sea action in a short while but for the protection afforded by these riprap deposits. At Cobb Point Bar Light Station, Potomac River, Md., 800 tons of riprap stone were deposited on the southeast side of the station, forming an ice breaker and protecting same from ice fields carried against it by the ebb tide of the Potomac River. At Old Plantation Flats Light Station, Chesapeake Bay, Va., 4,600 tons of riprap stone was placed in a pyramidal form under this screw pile lighthouse, completely encasing the foundation piles and reinforcing the structure. At Brant Island and Neuse River Light Stations, Pamlico Sound, N. C., 800 tons of riprap stone were placed under the former and 400 tons under the latter to restore the stability of the structures formerly attained by underwater bracing, all of which was carried away by ice. A new foundation of piles and mushroom castings was placed under Brant Island Light Station and the station leveled by the district force previous to the deposit of riprap stone. At Wade Point Light, Albemarle Sound, N. C., the broken foundation piles were welded in position by a patented process, thus restoring their original strength; subsequently a deposit of 600 tons of riprap stone, to add stability to the station, was made. At Hatteras Inlet Light Station, Pamlico Sound, N. C., the underwater bracing carried away by ice was replaced. Total amount expended from both appropriations to June 30, 1920, \$235,612.57.

Gas buoys, fifth lighthouse district.—Appropriations amounting to \$125,000 were made by acts of Congress approved July 1, 1918, and November 4, 1918, for additional gas buoys for the improvement of aids to navigation in the fifth district. Requisition has been made on the general depot for the following: Five gas and whistling buoys, 8 gas and bell buoys, 13 gas buoys, 19 buoy lanterns, and other material required for gas buoys. In addition, 1 gas and whistling buoy has been purchased for Cape Lookout, Harbor of Refuge, N. C. The total obligations for the above to June 30, 1920, are \$122,044.79. Of the above buoys and material, 2 gas and whistling buoys, 6 gas and bell buoys, and 3 gas buoys, with other material, have been delivered. The amount actually expended to June 30, 1920, was \$37,696.

SIXTH DISTRICT.

St. Johns River, Fla.—The act of July 1, 1916, appropriated \$66,000 for improving aids to navigation and establishing new aids in the St. Johns River, Fla., between Jacksonville and the sea.

From this appropriation the following works have been accomplished: Eight minor lights, 3 unlighted beacons and 2 gas-lighted buoys have been established; 15 light structures have been rebuilt; additional unlighted buoys established and buoyage improved by changing type; various light structures repaired and daymarks enlarged; and illuminating apparatus purchased for converting 3 range lights from fixed oil to flashing acetylene. The amount expended to June 30, 1920, was \$37,677.56.

SEVENTH DISTRICT.

Florida Reefs, Fla.—The act of July 1, 1916, appropriated \$75,000 for establishing additional aids, and repairing and improving existing aids. Under this appropriation part of the illuminating apparatus has been purchased. Contract was entered into October 11, 1919, for furnishing metal work and glass for two light towers, one for Molasses Reef and one for Pacific Reef, Fla., in the sum of \$62,864, delivery to be made within nine months. Probable date of completion July 30, 1921. Amount expended to June 30, 1920, \$4,059.72.

Dwelling, Dry Tortugas Light Station, Fla.—The act of July 19, 1919, appropriated \$50,000 for light-keepers' dwellings. The amount allotted this district for this work is \$6,500. During the fiscal year various preliminary plans were prepared, but had to be rejected, as the estimated cost at the increased prices for materials and labor exceeded the amount allotted. Plans and specifications were further delayed because additional technical assistance could not be secured at the salary offered. Preliminary plans and specifications for a dwelling at an estimated cost within the amount allotted has finally been completed by the Lighthouse Bureau, and advertisement for proposals will be issued as soon as practicable. Date of completion indefinite. Amount expended to June 30, 1920, nothing.

Repairing and rebuilding aids to navigation, seventh and eighth lighthouse districts.—The act of March 6, 1920, appropriated \$125,000 for rebuilding, repairing, and re-establishing such aids to navigation and structures connected therewith as were damaged or destroyed in the seventh and eighth lighthouse districts by the hurricane of September, 1919. Of this amount \$55,000 was allotted to the seventh district. During the fiscal year the following work was done payable from this appropriation:

Tender *Iry*, repairs to stern quarter being made at United States Naval Station, but not completed on June 30.

Key West Lighthouse Reservation: Repairs to roof of dwelling almost completed on June 30.

Rebecca Shoal Light Station: Material for repairing roof purchased during the year.

Dry Tortugas Light Station: Material for repairing roof purchased during the year.

Buoys and buoy appendages have been ordered.

The other work payable from this appropriation has been delayed due to inability to get technical assistance at the salary offered. Probable date of completion June 30, 1921. Amount expended to June 30, 1920, \$10,984.44.

EIGHTH DISTRICT.

Aids to navigation, Atchafalaya Entrance Channel, La.—The act of October 22, 1913, appropriated \$50,000 for establishing aids to navigation in Atchafalaya Entrance Channel, La. During the fiscal year ended June 30, 1916, Point Au Fer Reef Light-house and Atchafalaya Entrance Channel Lights Nos. 1, 3, 5, 7, 9, and 2 were completed. A 42-foot motor launch was completed by the United States Naval Station, New Orleans, La., during the fiscal year 1918, at a cost of \$6,951.71. Amount expended to June 30, 1920, \$48,119.97.

Aids to navigation, Mississippi River, La.—The act of July 1, 1916, appropriated \$50,000 for the improvement of aids to navigation of the Mississippi River below New Orleans. Contract was entered into June 22, 1917, for furnishing 25 structural steel towers. The towers were delivered to the Mobile Depot in 1919. The towers were erected on reinforced concrete blocks each 9 feet square and 25 oil lens lantern lights were shown therefrom. All the work is completed except the purchase of additional illuminating apparatus, etc. Amount expended to June 30, 1920, \$39,440.69.

Light-keepers' dwellings.—The act of July 19, 1919, appropriated \$50,000 for constructing light-keepers' dwellings and appurtenant structures, of which \$6,500 was allotted this district for building a keepers' dwelling at South Pass Range Rear Light

Station, La. The preparation of plans and specifications is underway in the district office. During the fiscal year no obligations were incurred.

Repairing and rebuilding aids to navigation, Gulf of Mexico.—The act of February 28, 1916, appropriated \$200,000 for repairing and rebuilding aids to navigation damaged or destroyed by hurricane on the Gulf of Mexico. In addition to the work which had been completed, as stated in the annual reports for the fiscal years ended June 30, 1917, June 30, 1918, and June 30, 1919, there is given below a list of the work that has been completed during the present fiscal year and that in progress. During the fiscal year the following portions of the work have been completed:

Biloxi Light Station, Miss.—Repaired lantern, galleries of dwelling and the out-buildings; scaled and painted tower and painted station.

Calcasieu Range Rear Light Station, La.—Rebuilt 1,470 feet of walks, boathouse, and made numerous minor repairs to station.

The following work is in progress at the end of the fiscal year:

Galveston Depot, Tex.: Creosoted piles and untreated lumber, etc., purchased.

Amount expended to June 30, 1920, \$188,182.18.

The act of September 8, 1916, appropriated \$125,000 for repairing and rebuilding aids to navigation damaged or destroyed by hurricane on the Gulf of Mexico, of which \$122,200 was allotted for this district. In addition to the work which had been completed as stated in the annual reports for the fiscal years ended June 30, 1917, June 30, 1918, and June 30, 1919, there is given below a list of the work that has been completed during the present fiscal year and that in progress. During the fiscal year the following portions of the work have been completed:

Cypress Range Lights, La.: Rebuilt both lights as oil lens lantern lights on posts on mud sills.

South Pass West Jetty Range Front Light and Fog Signal Station, La.: Built 500 feet of walk on creosoted piles from river to site of new fog-signal structure.

Amount expended to June 30, 1920, \$111,126.42.

The act of March 28, 1918, appropriated \$100,000 for rebuilding, repairing, and reestablishing aids to navigation and structures connected therewith on the coast of the Gulf of Mexico damaged or destroyed by hurricane. In addition to the work which had been completed, as stated in the annual reports for the fiscal years ended June 30, 1918, and June 30, 1919, there is given below a list of work which has been completed during the present fiscal year and of that in progress. During the fiscal year the following portions of the work have been completed:

Barataria Bay Light Station, La.: Renewed sills under dwelling, screens, and repaired windows, doors, and blinds; painted station.

Bayou St. John Light Station, La.: Renewed gutters; repaired roof of dwelling and painted station.

Bunch Timber Range Lights, Fla.: Repaired both single-pile structures.

Caucus Cut Range Front Light, Fla.: Rebuilt in new location, as 9 iron-cased pile structure showing acetylene light.

Choctawhatchee East Pass Range Lights, Fla.: Rebuilt both single-pile structures showing lens lantern lights.

Circle Crossing Range Rear Light, Fla.: Repaired single-pile structure.

Fort Barrancas Range Rear Light Station, Fla.: Rebuilt 4-pile lighted structure; repaired steps, barn, fences, cistern, etc.

Fort McRee Cutoff Range Front Light, Fla.: Rebuilt in new location as 4-pile structure showing acetylene light.

Fort McRee Cutoff Range Rear Light, Fla.: Rebuilt in new location as 4-pile structure showing acetylene light.

Horn Island Light Station, Miss.: Placed 423.6 tons rock protection under, and around station.

Hurricane Crossing Range Rear Light, Fla.: Rebuilt single-pile structure.

Lower Pritchard Long Point Light, Fla.: Repaired single-pile structure.

Mobile Channel Lights Nos. 4 and 6, Ala.: Reinforced foundations and leveled platforms of both 9-pile structures.

Mobile Channel Light No. 8, Ala.: Rebuilt 9-pile structure on former foundation.

Pensacola Light Station, Fla.: Repaired cistern foundation, cistern, walk, and renewed drain; painted tower and dwelling.

St. Joseph Point Range Light Station, Fla.: Rebuilt range front light as a 4-pile structure; laid concrete pavement under entire dwelling; repaired walks, fences, oil house, outbuildings, and painted station.

Santa Rosa Sound Range Lights, Fla.: Rebuilt both four iron-cased pile structures showing lens lantern lights.

South Pass East Jetty Light Station, La.: Built 60-foot walkway; repaired 500-foot walk; repaired gallery, blinds, and windows.

Upper Pritchard Long Point Light, Fla.: Repaired single-pile structure.

The following work is in progress at the end of the fiscal year:

Pass A Loutre Light Station, La.: Lumber purchased for raising dwelling and outbuildings and rebuilding boathouse and walks.

South Pass Jetty Lights and South Pass Range Front Light, La.: Lumber purchased for rebuilding walks.

South Pass Range Rear Light Station, La.: Lumber purchased for rebuilding walks and bulkhead.

Amount expended to June 30, 1920, \$76,618.33.

Repairing and rebuilding aids to navigation, seventh and eighth lighthouse districts.—The act of March 6, 1920, appropriated \$125,000 for repairing and rebuilding aids to navigation damaged or destroyed by hurricane on the Gulf of Mexico, of which \$70,000 was allotted this district. The following work was in progress at the end of the fiscal year:

Halfmoon Reef Light Station, Tex.: Materials have been delivered to station and framing of joists is in progress.

Houston Channel Entrance Range Lights, Tex.: Bids have been solicited for purchase of riprap protection.

Matagorda Light Station, Tex.: Bids are being solicited for purchase of creosoted lumber.

Sabine Bank Light Station, Tex.: Castings have been ordered for repairing station.

South Pass East Jetty Light Station, La.: Lumber has been purchased and steps are being taken to purchase steel for repairing foundation.

South Pass Jetty Lights and Fog-Signal Station, La.: Plans and specifications have been approved and steps are being taken to purchase lumber.

Texas City Channel Cut A Range Lights, Tex.: Bids have been solicited for purchase of riprap protection.

Amount expended to June 30, 1920, \$1,069.57.

Sabine Pass Jetty Light, La.: The act of May 27, 1908, appropriated \$40,000 for a light and fog signal at or near the end of Sabine Pass Jetty. Nothing has been done on the work in view of the proposed project of the War Department to extend the jetties to the 25-foot contour, a distance of possibly 2 miles. At the close of the fiscal year 1920 no money had been expended or obligated.

Sand Island Light Station, Ala.: The act of July 1, 1919, appropriated \$37,000 for improvements. Bids were solicited for purchase of riprap protection, but were rejected as being excessive. Amount expended to June 30, 1920, \$9.42.

NINTH DISTRICT.

Point Borinquen Light Station, P. R.—The act of June 12, 1917, appropriated \$85,000 for the reconstruction of Point Borinquen Light Station on a new site. The metal work and lantern furnished under contract have been delivered and contract has been let for the construction of a concrete tower and dwelling for two keepers which are nearing completion. The illuminating apparatus is on hand. Work is 85 per cent completed. Amount expended to June 30, 1920, \$47,294.18.

Aids to navigation, Guantanamo Bay, Cuba.—The act of July 1, 1918, appropriated \$14,000 for dwellings for keepers of lights in Guantanamo Bay, Cuba, and improving the lighting. The dwelling has been built by purchase of materials and hired labor. Skeleton steel tower for Hicacal Beach and Fisherman Point Ranges and electric equipment for these lights are on hand. Amount expended to June 30, 1920, \$11,817.81.

Dwelling, Port San Juan Light Station.—The act of July 19, 1919, appropriated \$50,000 for light keepers' dwellings, of which \$5,000 were allotted the ninth lighthouse district. The dwelling for two keepers is now under construction by purchase of material and hired labor. Amount expended to June 30, 1920, \$1,172.81.

Point Jiguero Light Station, P. R.—The act of July 1, 1919, appropriated \$24,000 for rebuilding Point Jiguero Light Station, P. R. Bids were received, but were in excess of the estimates, and therefore rejected. Orders have been placed for materials for doing the work by hired labor. Amount expended to June 30, 1920, \$235.65.

TENTH DISTRICT.

Conneaut Harbor, Ohio.—The act of July 1, 1916, appropriated \$63,500 for a light and fog-signal station and improving aids to navigation at Conneaut Harbor, Ohio, and the deficiency appropriation act, fiscal year 1920, appropriated \$19,500 for completing the light and fog-signal station. Work resumed at site June 9, 1920. Materials nearly all on hand to complete construction. Structure completed to watchroom floor

including roof. Probable date of completion, December 1, 1920. Amount expended to June 30, 1920, \$63,675.52.

Fairport Harbor, Ohio.—The act of June 12, 1917, appropriated \$42,000 for improving aids to navigation at Fairport Harbor, Ohio. Plans for this project approved by Bureau, August 14, 1919. Steel plates, etc., for building purchased and being fabricated at Buffalo Lighthouse Depot, N. Y. Twelve tons iron castings being made under contract. Owing to war conditions and increased prices the amount appropriated is insufficient, and an additional appropriation of \$44,000 has been recommended. Probable date of completion, September 30, 1921. Amount expended to June 30, 1920, \$11,984.52.

ELEVENTH DISTRICT.

Detroit River, Mich.—The act of March 4, 1911, appropriated \$210,000 for establishing aids to navigation along the Livingstone Channel, Detroit River, Mich., including authority to locate and construct lights and to place buoys necessary to properly mark this channel. On June 30, 1917, 12 concrete piers had been completed and 9 beacon lights placed in commission. The other 3 await completion of the channel before they can be utilized. Funds have been made available to the War Department for continuing the widening of the channel so that it should be possible to construct these three beacons in the near future. Thirteen gas buoys and 21 spar buoys are now used to mark the channel in addition to the lights on piers. Two additional pier lights will be established, taking the place of gas buoys now maintained on the west side. This can not be done until the proposed channel widening has been completed. In addition to the lights along the channel proper a semaphore system for controlling the movements of vessels through the channel has been constructed and placed in operation. One of the semaphores, giving the first warning to vessels, has been moved to a point farther away from the entrance of the channel, in order that vessels checked by it may have more room for anchorage and maneuver in case of necessity. The semaphore lights for this station have been changed from oil to acetylene with a resultant increase in power.

These semaphore lights are now temporarily unused while work of the widening of the channel is in progress.

The Canadian Government, following a conference on the subject, has taken over the maintenance of a light vessel on the former station of Bar Point Light vessel, so that it will be unnecessary to establish a light station there as had been contemplated from this appropriation.

Total amount expended to June 30, 1920, \$150,988.08.

Aids to navigation, Fighting Island Channel, Detroit River, Mich.—The act of July 1, 1916, appropriated \$25,000 for aids to navigation, Fighting Island Channel, Detroit River, Mich. Under this appropriation a nonattended acetylene flashing light has been established at the southern entrance on the east side of the channel, and a similar light at the northern entrance on the east side, these lights being known as Fighting Island South and North Lights, respectively. Intermediate, between the above permanent lights on the east side, are installed three type S acetylene gas buoys at approximately equal intervals. On the west side and approximately opposite the three gas buoys, two permanent lights are maintained with one type S acetylene gas buoy intermediate. Fighting Island South Light was placed in commission in November, 1916, and the North Light in December, 1917. Gas buoy stations were marked temporarily by Pintsch gas buoys, pending installation of acetylene buoys which were placed on station at the opening of navigation, 1918. Four ranges along the channel, formerly maintained, are now eliminated, single lights being maintained in each case, as the channel is now straight for the entire distance. Acetylene lighting equipment converting three of these single lights to nonattended, has been purchased and installed. The Fighting Island North Light, which was constructed in 13 feet of water and completed during the past year, serves an important purpose in providing a light at the entrance to the channel in the spring before gas buoys can be placed and in the fall after their removal is necessary. It further serves as a location for one of the Livingstone Channel semaphore stations.

If proper arrangements can be made for disposal of unused dwellings to which towers are now attached, steel towers will be erected for two lights now maintained as nonattended.

Amount expended to June 30, 1920, \$21,283.03.

Aids to navigation, Keweenaw Waterway, Mich.—The act of June 12, 1917, appropriated \$105,000 for aids to navigation, Keweenaw Waterway, Mich. During the past season the major portion of all work was completed, and the work was again resumed with the opening of navigation this season. All work is now nearing completion, the main light and fog signal being in readiness for placing in commission.

The project as now being carried out consists of the establishment of a shore station at the present Keweenaw waterway station, consisting of quarters for three keepers and their families, a power house for generating electric current for lighting purposes and for furnishing compressed air to the main fog signal, and in addition other small buildings, such as boathouse, etc. At the end of the breakwater, at Portage Entry, the present fog bell tower and acetylene light will be replaced by a concrete and steel tower, with electric light and air siren fog signal. This structure will be high enough so that its light will make unnecessary the further maintenance of the present Portage River Main Light. Over 20 minor lights along the Portage River will be connected through an electric wiring system with the power house and all of these beacons operated by electricity. Each one will be equipped with suitable alarm devices and arranged for guarding against the failure of electric bulbs in service. The provision of new quarters includes the construction of one new building and the remodeling of an old building to provide a double set of quarters.

It will be possible to put into commission only 13 of the minor lights for the present, owing to delay of the War Department in completing Princess Point cut-off. It is understood that condemnation proceedings for obtaining land for this improvement are now under way and that same will be done next season, when electrification of minor lights can be completed.

The derrick scow constructed under this appropriation for this special work has rendered excellent service during the past year, fully justifying its construction in savings effected. All work under this project is being carried out by purchase of material and hired labor, utilizing the regular field force of the district so far as possible.

Amount expended to June 30, 1920, \$104,258.83.

Aids to navigation, St. Marys River, Mich.—The act of November 7, 1918, appropriated \$80,000 for the purpose of improving aids to navigation in the St. Marys River, Mich. The work which it is proposed to carry out in the improvement of these aids under this appropriation consists in making changes of the Cedar Point Range Light, Pipe Island and Frying Pan Island lights to nonattended acetylene, and a change in the location of the Cedar Point Range to Round Island in the St. Marys River; the establishment of two new beacons nonattended acetylene, to mark a new upbound channel recently established at Pipe Island; the reconstruction of North Entrance Light No. 27, as a nonattended Pintsch gas beacon, and providing suitable quarters for the keeper on shore; the repair and reconstruction as necessary of lights in the Middle Neebish Cut and in the West Neebish Channel; and in the improvement of the Middle Neebish Channel lights by the installation of modern lighting equipment.

At the close of the fiscal year the work at Cedar Point, Pipe Island Twins, Squaw Island, and Little Rapids Cut had been practically completed and work on the repair of structures in the Middle Neebish Channel was in progress. All materials are at hand for proposed improvements at Frying Pan Island and Pipe Island. It is anticipated that all work on these items will be completed this season and riprap work for the West Neebish Channel structure placed under contract if prices for same can be obtained. It will be impossible to complete all work which should be done under this appropriation including the establishment of range lights in the West Neebish Channel and dredging away of old stone foundations, so that an additional appropriation for this work is being requested.

Amount expended to June 30, 1920, \$28,862.42.

Spectacle Reef Light Station, Mich.—The act of July 1, 1918, appropriated \$28,000 for certain repairs to Spectacle Reef Light Station, Mich.

The Spectacle Reef Tower is of stone, extending from bedrock and surrounded by a platform deck of mass concrete construction on timber cribwork, this area being 90 feet square. Serious undermining of the concrete work has taken place, making it necessary to effect repairs before this erosion has become great enough to menace the safety of the structure. Owing to the great amount of construction work underway, requiring practically all of the spare time of the lighthouse vessels in attendance thereon, delivering materials, etc., it has been impracticable to start this construction up to the present time. The work is such that it can not be economically carried out without practically the continuous attendance of a vessel. Preliminary examinations have been made and arrangements will be completed for carrying out the work during the most favorable weather this year if tender service can be made available and prospective costs do not prove prohibitive.

Amount expended to June 30, 1920, nothing.

Detroit Lighthouse Depot, Mich.—The act of July 1, 1918, appropriated \$53,000 for improvements at the Detroit Lighthouse Depot, Mich.

The work contemplated under this appropriation consists primarily in the construction of a reinforced concrete wharf to replace the present timber wharf, which

has deteriorated to such an extent that it requires a complete renewal. Plans for the new wharf, which have been approved, provide for extending the construction out to the harbor line, a distance of approximately 100 feet, making the east side of the wharf straight and widening the connecting portion to shore. This plan provides ample storage space for gas buoys and berthing facilities for all vessels of the district which will require to be provided with a berth at this point. In connection with the work it will be necessary to do some work of dredging to obtain a greater depth of water over shoal spots, including a portion of the old wharf, which will be entirely removed. The construction approved consists of reinforced concrete wall supports, carrying a reinforced concrete slab and beam deck with wood fenders, and industrial track as necessary to facilitate the loading of vessels. These reinforced concrete walls are in turn carried on a timber grillage supported by wood piles cut off below the water level. The project also includes an extension of the Detroit Depot Lamp Shop, together with the installation of additional machinery required for the needs of the district. Certain other minor improvements at the depot will be carried out at the same time.

Up to the close of the fiscal year the entire outer portion of the wharf had been constructed and placed in service. Steel reinforcing and wood piles are on hand for the remaining portions of the wharf, which will connect to shore. The lamp-shop building is nearing completion, except that no mechanical equipment has been provided.

Owing to the greatly increased cost of labor and materials, it will not be possible to complete more of the work than that indicated above, and an additional appropriation will be required. In its present condition the portion of the wharf completed can not be used to the fullest extent, owing to deteriorated condition of the connecting portion to shore.

Amount expended to June 30, 1920, \$48,343.68.

TWELFTH DISTRICT.

Chicago Harbor Light Station, Ill.—The act of June 12, 1917, appropriated \$88,000 for the removal and rebuilding of Chicago Harbor Light Station on a new site at the south end of the north arm of the extension of the exterior breakwater, north side of the Chicago Harbor Entrance; also for the establishment of two minor lights on the north and south ends of the south arm extension of breakwater. The sundry civil act approved July 19, 1919, appropriated \$6,400 additional for completing the above project, this additional appropriation having been made necessary by the great advance in costs after original appropriation was made.

The reinforced concrete superstructure of the foundation pier for Chicago Harbor Light Station was practically completed by the contractors in December, 1917 (resting on timber crib provided in breakwater structure by United States engineers in December, 1916). The removal and recreation of the old cast-iron tower and new added steel fog-signal building and boathouse was accomplished in season of 1918 by the lighthouse working party and the interior lining and finish was completed in November, 1919. Permanent light was established August 1, 1918, and fog signal established May 8, 1918. Small concrete foundation pier with steel tower and acetylene light for Chicago Harbor Entrance, South Side Light, was built in 1918 and light established August 9, 1918.

The entire project is now complete except the construction of small concrete landing dock at the above South Side Light and the construction of the south end light, materials for which are now on hand. The south end light awaits the completion of breakwater extension by United States engineers, possibly in 1921 or 1922.

The estimated cost for the work yet to be done under this project is \$2,921.15, which is covered by the amount still available under the special appropriations.

Amount expended to June 30, 1920, \$91,478.85.

Indiana Harbor, Ind.—The act of June 12, 1917, appropriated \$100,000 for establishment and improvement of aids to navigation, Indiana Harbor, Ind. The project has been advanced as follows:

East Breakwater Light and Fog Signal Station: The United States engineers are to furnish the underwater portion consisting of stone-filled crib and are to place a 3-foot raise of concrete on crib for the Lighthouse Service. Crib has been completed and will be placed in July, 1920. Preliminary plans for a hollow reinforced concrete superstructure (on crib), 44 by 65 by 20 feet high, with a reinforced concrete building, have been approved by the Bureau, and construction of same will be begun and completed in 1921.

East Pier Light: Steel tower, 31 feet on small concrete base with acetylene light, was completed May 12, 1920, and light exhibited June 5, 1920.

West Breakwater Light: Steel tower 31 feet has been purchased and acetylene equipment ordered. The placing of small concrete foundation pier and erection of

light awaits the completion of easterly end of west breakwater by United States engineers, possibly in 1921 or 1922.

Expended to June 30, 1920, \$2,273.40.

Manitowoc, Wis.—The act of July 19, 1919, appropriated \$50,000 for light-keepers' dwellings, including sites therefor, and an allotment of \$1,000 was made the twelfth lighthouse district for a site for a keeper's dwelling at this place. The site selected is at the inner end of North Breakwater. The city council has taken favorable action toward granting the property required to the Lighthouse Service for a consideration. Negotiations are now in progress between the city and the original owners to clear the city's title of certain reservations in the deed, under which city holds the required property.

Expended to June 30, 1920, none.

Poverty Island, Mich.—Under the act approved July 19, 1919, appropriating \$50,000 for light-keepers' dwellings, an allotment of \$6,500 was made the twelfth lighthouse district for a dwelling at Poverty Island. The plans have been prepared and approved for bungalow-type dwelling for first assistant keeper, of hollow-tile construction, with concrete foundation. Most of the materials have been purchased and it is expected that construction will be completed in August or September, 1920.

Expended to June 30, 1920, \$1,646.16.

SIXTEENTH DISTRICT.

Ketchikan lighthouse depot, Alaska.—The act of July 1, 1918, appropriated \$90,000 for a lighthouse depot and the necessary equipment for the sixteenth lighthouse district. A site at Ketchikan, Alaska, previously set aside for the purpose by Executive order, has been developed. Construction work was suspended during the past winter, owing to the funds becoming exhausted. A further appropriation of \$12,000 became available in the spring of 1920 through an item contained in the deficiency bill approved March 8, 1920, and work was resumed. A wharf on creosoted piling has been built, a shed erected on the wharf, and a two-story reinforced concrete storehouse has been constructed. The new depot will be occupied within a few days after the end of the fiscal year, although the storehouse has only temporary roof and is not otherwise finished owing to lack of funds. The amount expended to June 30 1920, is \$98,804.77.

Aids to navigation, Alaska.—The act of June 12, 1917, appropriated \$60,000 and that of June 19, 1919, \$75,000 for establishing and improving aids to navigation in Alaskan waters. During the year 1920, 3 gas and bell buoys and 12 acetylene lights were established from the above appropriations. Amount expended to June 30, 1920, from appropriation of June 12, 1917, \$56,116.27. Amount expended to June 30, 1920, from appropriation of June 19, 1919, \$50,921.26.

SEVENTEENTH DISTRICT.

Aids to navigation, Coquille River, Oreg.—The act of July 1, 1916, appropriated \$6,000 for this project, which contemplated the removal of the light and fog signal to the south side of the entrance. Navigators and others have petitioned that no change be made in the position of the present light and fog-signal station. Correspondence was carried on throughout the year with the port of Bandon and the local electric light company in the endeavor to arrive at some satisfactory arrangement regarding the additional lights desired by the port of Bandon on the south jetty. The port desires the Lighthouse Service to assume the cost and operation of a system of lights of a nature not in use elsewhere, and while there is no doubt that the system would be very valuable, no satisfactory arrangement regarding the taking over of these lights by the Government could be arrived at. The matter is still under correspondence. It is hoped to come to some definite conclusion with the port during the next fiscal year, that the matter may be closed and the funds expended for most essential work. Additional aids established during the year have consisted of five post lights on the river between Bandon and Coquille. Amount expended to June 30, 1920, \$40.34.

Aids to navigation, Wash. and Oreg.—The act of June 12, 1917, appropriated \$35,000 for new aids and improvements to existing aids. Under this appropriation 3 acetylene lights, 17 post lanterns using oil, 2 minor electric lights, 1 electric post lantern light were established, 2 electric lights and fog signals were moved, 1 fourth-order light was changed to electric incandescent, 1 electric power station complete constructed at Cape Disappointment Light Station for furnishing current to 4 lights in the vicinity,

and the candlepower of 1 acetylene installation was increased. Three fog signals, 2 post lanterns, oil, 2 post lanterns, electric, and 1 acetylene light were uncompleted. It is anticipated that the authorized installations will consume the balance of the appropriation during the next fiscal year. Total amount expended to June 30, 1920, \$25,062.20.

Light-keepers' dwellings.—Allotment from appropriation of July 19, 1919, \$6,500 for dwellings at Yaquina Head Light Station, Oreg. Plans and specifications have been prepared in readiness for advertising. It is anticipated that the work will be finished during the present calendar year. No expenditures made to June 30, 1920.

EIGHTEENTH DISTRICT.

Point Vicente, Calif.—The act of July 1, 1916, appropriated \$80,000 for establishing a light and fog signal at Point Vicente, Calif. The site was under controversy, and the United States attorney prepared the data preliminary to entering suit for condemnation of suitable site; owing to more satisfactory arrangements with the land company as to purchase of site, action has been deferred and the condemnation suit has been postponed. The United States attorney has been instructed to have the land company furnish abstract of title to the property.

The drawings and details have been completed and approved for the tower, fog-signal building, the keeper's and the assistant-keeper's quarters. The erection of the fog-signal building, keeper's and one assistant-keeper's quarters have been authorized; specifications are now being prepared so that bids may be invited for the construction of the buildings. The Bureau standard cylindrical helical bar lens, 9 feet 9 inches inside diameter, will be used. The lens will be assembled at the general depot. The date of completion will depend upon the acquisition of site. Amount expended to June 30, 1920, \$13.50.

NINETEENTH DISTRICT.

Aids to navigation, Pearl Harbor, Hawaii.—The act of March 3, 1915, authorized \$80,000 for establishing aids in Pearl Harbor, which amount was appropriated by act of June 12, 1917.

The original project, approved by Bureau and satisfactory to the Navy Department, consisted of 2 lighted buoys and 17 lighted beacons and daymarks for marking the entrance channel to Pearl Harbor.

This system called for steel towers supported by reinforced concrete piers, some on concrete piles, and with one exception all located in water near the channel's edge.

A bid was received on this project on September 10, 1919, being, however, in excess of funds available. Due to this fact, and also because of a change in the Navy Department's program for future development of Pearl Harbor, the Bureau rejected the bid on November 5, 1919, and accepted a revised system, including floating aids suggested by the Navy.

The revised project, consisting of electric lights on disappearing towers for the two outer reaches of the channel and 17 lighted "M" type acetylene gas buoys, and 11 unlighted buoys, was approved by Bureau on January 29, 1920.

Detailed plans for three disappearing and one stationary steel towers are practically completed. Contract for buoy bodies and illuminating apparatus have been made, and the Navy Department's estimate for installation of electric transmission lines accepted. Establishment, in all probability, will be completed by June 30, 1921.

Amount expended to June 30, 1920, \$9,214.07.

Light-keepers' dwellings, Diamond Head Light Station, Hawaii.—By act approved July 19, 1919, \$50,000 was appropriated for construction of keepers' dwellings and \$5,000 was allotted for a keeper's dwelling at this station.

Blue prints showing proposed location, floor plan, and elevations of a double wall, frame construction, plastered interior wall dwelling, estimated to cost \$4,980 was approved by the Bureau on March 5, 1920.

Detailed plans and specifications will be prepared in the near future and bids received at an early date. Probable date of completion April 1, 1921. No funds expended to June 30, 1920.

UNEXPENDED BALANCES ON JUNE 30, 1920, FROM APPROPRIATIONS FOR SPECIAL WORKS.

District.	Title of appropriation.	Acts.	Balance.
General...	Repairing and rebuilding aids to navigation, Atlantic coast.	Mar. 28, 1918; Nov. 4, 1918...	\$11,967.81
	Light vessels for general service.....	Aug. 24, 1912; Aug. 26, 1912..	110,699.12
	Light vessels for general lake service.....	June 12, 1917.....	59,600.98
	Radio installations on lighthouse tenders.....	do.....	35,430.84
	Oil houses for light stations.....	June 25, 1910.....	330.40
	Repairing and rebuilding aids to navigation, seventh and eighth lighthouse districts.	Mar. 6, 1920.....	122,327.75
	Vessels for Lighthouse Service.....	Nov. 4, 1919.....	759,047.06
	Light-keepers' dwellings.....	July 19, 1919.....	47,146.80
1st.....	Dog Island Light, Me.....	July 1, 1916.....	381.46
2d.....	Cape Cod Canal Lights, Mass.....	Aug. 1, 1914.....	94.91
	Wood's Hole Lighthouse Depot, Mass.....	July 1, 1916.....	417.14
	Nantucket Harbor Fog Signal, Mass.....	Mar. 28, 1918.....	6,413.88
	Depot for second lighthouse district.....	July 1, 1918.....	71,977.93
3d.....	Hunt's Point Light Station, N. Y.....	Mar. 4, 1911.....	1,479.79
	Aids to navigation, Hudson River, N. Y.....	July 1, 1916.....	1,286.06
	Tender for third lighthouse district.....	June 12, 1917.....	149,822.59
	Aids to navigation, East River, N. Y.....	do.....	56.11
	Great Salt Pond Light Station, R. I.....	do.....	1,296.45
	Staten Island Lighthouse Depot, N. Y. (wharves).	Mar. 28, 1918.....	3,120.88
	Staten Island Lighthouse Depot, N. Y. (carpenter shop).	Aug. 1, 1914.....	1,144.51
	Staten Island Lighthouse Depot, N. Y. (office and laboratory).	June 12, 1917.....	1,340.63
	Staten Island Lighthouse Depot, N. Y. (machineshop).	July 19, 1919.....	30,000.00
	Ambrose Channel Lighted Buoys, N. J.....	July 1, 1918.....	256.20
	National security and defense, Department of Commerce, 1919, Tompkinsville.	do.....	66,928.67
	Execution Rocks Light Station, N. Y.....	July 19, 1919.....	9,403.10
	Riprap protection for light station, third lighthouse district.	do.....	149,939.28
4th.....	Joe Flogger Shoal Light Station, Delaware River.	June 30, 1906; July 1, 1918....	9,377.47
	Aids to navigation, Delaware River, Pa. and Del.	July 1, 1916.....	62.20
5th.....	Thimble Shoal Light Station, Va.....	June 25, 1910; Aug. 26, 1912..	344.61
	Lighting Norfolk Harbor, Va.....	Mar. 4, 1911.....	212.40
	Cape Charles Light Vessel, Va.....	June 12, 1917.....	123,900.78
	Aids to navigation, Chesapeake Bay, Md. and Va.	do.....	24,003.53
	Fifth lighthouse district gas buoys.....	July 1, 1918; Nov. 4, 1918....	36,226.45
	Diamond Shoal Light Vessel, N. C.....	Nov. 4, 1919.....	449,675.00
6th.....	Aids to navigation, St. Johns River, Fla.....	July 1, 1916.....	30,353.26
7th.....	Aids to navigation, Florida Reefs, Fla.....	do.....	71,536.88
8th.....	Galveston Jetty Light Station, Tex.....	June 11, 1896; May 27, 1908....	101.87
	Sabine Pass Jetty Light Station, Tex.....	May 27, 1908.....	40,000.00
	Southwest Pass Light Vessel, Mississippi River.	Oct. 22, 1913.....	14,360.75
	Aids to navigation, Atchafalaya Entrance Channel, La.	do.....	4,103.23
	Repairing and rebuilding aids to navigation, Gulf of Mexico.	Feb. 28, 1916; Sept. 8, 1916; Mar. 28, 1918.	46,427.91
	Aids to navigation, Mississippi River, La.....	July 1, 1916.....	13,305.31
	Tender and barge, for eighth lighthouse district.	do.....	19,976.36
	National security and defense, Department of Commerce, 1919 (Caribbean Sea).	July 1, 1918.....	25,978.95
	Sand Island Light Station, Ala.....	do.....	36,900.58
9th.....	Aids to navigation, Guantanamo Bay, Cuba.....	do.....	2,561.57
	Navassa Island Light Station, West Indies.....	Oct. 22, 1913.....	3,946.11
	Point Borinquen Light Station, P. R.....	June 12, 1917.....	40,841.54
	Point Jiguero Light Station, P. R.....	July 19, 1919.....	23,764.35
10th.....	Aids to navigation, Ashtabula Harbor, Ohio.....	Oct. 22, 1913.....	2,054.97
	Aids to navigation, Lorain Harbor, Ohio.....	do.....	25.46
	Aids to navigation, Conneaut Harbor, Ohio.....	July 1, 1916.....	20,308.85
	Aids to navigation, Toledo Harbor, Ohio.....	do.....	1,070.70
	Aids to navigation, Huron Harbor, Ohio.....	June 12, 1917.....	407.58
	Aids to navigation, Fairport Harbor, Ohio.....	do.....	30,015.48
11th.....	Detroit River Lights, Mich.....	Mar. 4, 1911.....	59,011.92
	Aids to navigation, Fighting Island Channel, Detroit River, Mich.	July 1, 1916.....	3,716.98
	Sand Hills Light Station, Mich.....	June 12, 1917.....	151.77
	Aids to navigation, Keweenaw Waterway, Mich.	do.....	741.17
	Detroit Lighthouse Depot, Mich.....	July 1, 1918.....	4,656.32
	Spectacle Reef Light Station, Mich.....	do.....	28,000.00
	Aids to navigation, St. Marys River, Mich.....	Nov. 4, 1918.....	51,137.58
12th.....	White Shoal Light Station, Lake Michigan.....	Mar. 4, 1907.....	23,141.05
	Chicago Harbor Light Station, Ill.....	June 12, 1917; July 19, 1919..	2,921.15
	Manitowoc Breakwater Light Station, Wis.....	do.....	2,920.04
	Aids to navigation, Indiana Harbor, Ind.....	June 12, 1917.....	97,726.60
16th.....	Aids to navigation, Alaska.....	July 19, 1919.....	40,471.55
	Cape St. Elias Light Station, Alaska.....	Oct. 22, 1913.....	200.16
	Depot for sixteenth lighthouse district.....	July 1, 1918; Mar. 6, 1920....	4,542.23
17th.....	Kellett Bluff Light Station, Wash.....	July 1, 1916.....	623.35
	Aids to navigation, Coquille River, Oreg.....	do.....	5,959.66
	Aids to navigation, Washington and Oregon.....	June 12, 1917.....	10,509.87
18th.....	Point Vicente Light Station, Calif.....	July 1, 1916.....	79,986.50
19th.....	Aids to navigation, Pearl Harbor, Hawaii.....	June 12, 1917.....	70,782.13

**SAVING OF LIFE AND PROPERTY BY VESSELS OR EMPLOYEES OF THE
LIGHTHOUSE SERVICE DURING THE FISCAL YEAR 1920.**

District.	Vessel or employee rendering service.	Vessel, etc., aided.	Nature of assistance.
1st.....	H. L. Nye, first assistant keeper; M. R. Beal, second assistant keeper, Seguin Light Station, Me.	Motor boat.....	Rendered assistance to three men lost in fog; furnished food and lodging.
	do.....	do.....	Towed boat with two men aboard to station and furnished gasoline and food.
	L. Allen, keeper, Petit Manan Light Station, Me.	Towboat Neptune.....	Rendered assistance to disabled tug 10 miles offshore.
	C. H. Newman, keeper, Pumpkin Island Light Station, Me.	Power boat Ark.....	Towed disabled boat to station and repaired engine.
	J. W. Haley, keeper, Perkins Island Light Station, Me.	Launch.....	Assisted in floating boat which had run on ledge.
	C. L. Knight, keeper, Squirrel Point Light Station, Me.	Power boat.....	Rendered assistance to two men adrift in boat without gasoline; furnished lodging.
	do.....	Launch.....	Towed disabled launch to safe anchorage.
	J. B. Dewyea, keeper; W. F. Reed, second assistant keeper, Halfway Rock Light Station, Me.	Schooner Annie Conley.	Secured and anchored abandoned lumber-laden schooner.
	Tender Zizania.....	Schooner.....	Assisted in pulling coal-laden schooner off Northeast Harbor Ledge.
	A. T. Faulkingham, keeper; A. Robinson, assistant keeper, Moose Peak Light Station, Me.	Lobster smack Cello...	Towed disabled smack to station and repaired propeller and shaft; furnished food and lodging to captain and engineer.
2d.....	H. L. Thomas, keeper; P. S. King, assistant keeper, Cape Poge Light Station, Mass.	Motor boat.....	Towed disabled motor boat containing three occupants to Edgartown, Mass.
	Tender Mayflower.....	Navy S. C. No. 109....	Extinguished fire on submarine chaser and towed it to Boston Navy Yard.
	Tender Anemone.....	Navy S. C. No. 93....	Floated submarine chaser which went ashore on Coaticus Flats, Nantucket, Mass.
	J. E. Rogers, keeper; C. E. Ellis, assistant keeper, Dumpling Rock Light Station, Mass.	Motor boat Nistia.....	Towed disabled motor boat with six men aboard to New Bedford Yacht Club, Mass.
	Carl D. Hill, keeper, Tarpaulin Cove Light Station, Mass.	Steamer Lake Crystal.	Took hawser aboard grounded steamer.
	do.....	Cuttyhunk Coast Guard motor boat No. 50.	Towed disabled motor boat to Robinsons Hole, Mass.
	A. A. Small, keeper, Narrows Light Station, Mass.	Steamer Mondoir.....	Piloted steamer to Boston, the captain of vessel having lost his bearings.
	Tender Azalea.....	Fish Commission Buildings, Woods Hole, Mass.	Assisted in fighting fire at Woods Hole, Mass., and in removing furniture from dwellings in path of fire.
	Tender Mayflower.....	Fishing schooner Dawn.	Towed disabled vessel into Boston Harbor.
	C. W. Vanderhoop, keeper; E. N. Larsen, assistant keeper, Sankaty Head Light Station, Mass.	Sankaty Head Light Station, Mass.	Assisted in protecting Lighthouse Service property from damage by fire which broke out in vicinity of Sankaty Head Light Station, Mass.
	J. M. Scharff, keeper; C. L. Turner, assistant keeper, Nantucket (Great Point) Light Station, Mass.	Seaplane No. 1189.....	Rendered assistance to seaplane, which was forced to land on beach.
	do.....	Fishing schooner Blanche F. Irving.	Assisted crew of schooner which agrounded at Point Rip.
	G. A. Faulkner, keeper, Palmer Island Light Station, Mass.	Power Boat Earl E73.	Towed power boat which was adrift and without gasoline.
	H. L. Thomas, keeper, Cape Poge Light Station, Mass.	Motor boat.....	Towed disabled motor boat containing two women and four children to place of safety.
	W. L. Anderson, jr., keeper, Cuttyhunk Light Station, Mass.	Sow and Pigs Bell Buoy, 2.	Assisted in securing and towing buoy which went adrift.
3d.....	H. L. Thomas, keeper; P. S. King, assistant keeper, Cape Poge Light Station, Mass.	Catboat Miscal.....	Rendered assistance in floating catboat which went ashore on Stony Point.
	Raymond E. Hall, keeper, Execution Rocks Light Station, N. Y.	Sloop Bob Cat.....	Rendered assistance to occupants of sloop which ran on rocks.
	Tender Pine.....	Catboat.....	Towed two boats with three passengers aboard to Atlantic City.

SAVING OF LIFE AND PROPERTY BY VESSELS OR EMPLOYEES OF THE LIGHTHOUSE SERVICE DURING THE FISCAL YEAR 1920—Continued.

District.	Vessel or employee rendering service.	Vessel, etc., aided.	Nature of assistance.
3d.....	W. H. Follett, keeper, Cedar Island Light Station, N. Y.	Yacht Flyer, A. W. Perine, owner.	Rendered assistance to yacht disabled by explosion and took three men to hospital.
	Tender Mistletoe.....	U. S. S. Connrer.....	Rendered assistance to vessel which had grounded.
	William F. Rhodes, keeper, Greens Ledge Light Station, Conn.	Rowboat.....	Went to assistance of three men who were unable to get ashore on account of wind and tide.
	Bartlett Reef Light Vessel.....	Motor launch.....	Sent motor boat to assistance of launch containing two men and four ladies; towed them to station and supplied gasoline.
	H. Burke, keeper, Port Jefferson Light Station, N. Y.	Canoe.....	Went to the assistance of man and woman and rescued them from drowning.
	Cornfield Point Light Vessel.....	Motor cruiser Silver Bell.	Towed disabled boat to Saybrook.
	Charles J. Kenney, keeper, Pecks Ledge Light Station, Conn.	Atlantic Yacht Club..	Rendered assistance to four men who were injured when clubhouse was destroyed by water-spout.
	Marvin E. Burnham, keeper, Lloyd Harbor Light Station, N. Y.	Schooner.....	During heavy gale rescued man and woman from leaking schooner in Huntington Bay.
	Charles Redfern, keeper, Point Comfort Light Station, N. J.	.....	Rescued woman from drowning while bathing at Point Comfort.
	Tender Pansy.....	.....	Picked man up during heavy wind and sea, drifting into the race.
	William Tutty, keeper, New Haven Light Station, Conn.	Yacht Sunbeam, R. R. Tappan, owner.	Rescued six men whose yacht had sunk, and raised yacht.
	Eugene H. Merry, keeper; Charles H. Douglass, second assistant keeper, Little Gull Island Light Station, N. Y.	Coal barges Agnes Howard and Commodore Barry.	Rendered assistance to two men, a woman, and three children when barges were wrecked.
	Tender Tulip.....	Coal barge.....	Towed to anchor in Gravesend Bay barge which had gone adrift.
	Rudolph Iten, keeper, Bridgeport Harbor Light Station, Conn.	Power boat.....	Towed disabled boat to station and furnished food and lodging to occupants.
	Eugene H. Merry, keeper, Little Gull Island Light Station, N. Y.	Rowboat.....	Towed to Fort Terry boat adrift without oars with two men aboard.
	Ezra Dunn, keeper, Great Salt Pond Light Station, R. I.	Crew of barge of Consolidated Coal Co.	Furnished food and clothing to crew of sunken barge.
4th.....	Charles J. Murphy, engineer, tender Iris.	.....	Rescued a seaman of the tender Iris from drowning.
5th.....	S. B. Robins, keeper, Old Plantation Flats Light Station, Va.	Rowboat.....	Assistance rendered to rowboat adrift with four men.
	J. T. Twiford, keeper, Brant Island Shoal Light Station, N. C.	Motor tug Emily.....	Assistance rendered motor tug which had become disabled.
	S. B. Robins, keeper, Old Plantation Flats Light Station, Va.	Schooner Juliet L. Hopkins.	Assistance rendered schooner which had become wrecked.
	J. W. Cooper, assistant keeper, Roanoke River Light Station, N. C.	Launch Laura.....	Assistance rendered launch which had become grounded.
	A. L. Davis, keeper, Cut-off Channel Range Lights, Md.	Motor boat.....	Towed into Jones Creek disabled motor boat with three occupants aboard.
	Tender Maple.....	Baltimore port.....	Assisted in fighting water-front fire in Baltimore port.
	Tender Laurel.....	Power boat Stonewall Jackson.	Towed power boat to Long Point.
	M. D. Swain, keeper, Newport News Middle Ground Light Station, Va.	Motor boat.....	Assistance rendered motor boat lost in a fog.
	M. B. Tolson, assistant keeper, Newport News Middle Ground Light Station, Va.	.....do.....	Do.
	W. J. Tate, keeper, North Landing River, etc., Aids, N. C.	Yacht Linnie.....	Assistance rendered yacht which had run aground.
	O. H. Daniels, keeper, Roanoke Marshes Light Station, N. C.	Yacht Tea Rose.....	Assistance rendered yacht during stormy weather.
	T. S. Johnson, assistant superintendent, fifth lighthouse district.	Gas buoy on Fishermans Island.	Recovery of gas buoy worth \$3,000, which was driven ashore by ice.
	James B. Hurst, keeper; V. J. Montague, assistant keeper, Wolf Trap Light Station, Va.	Motor boat.....	Assisted in safely landing at the station a motor boat with six persons saved from the Sedonia Curley, which was sunk.

SAVING OF LIFE AND PROPERTY BY VESSELS OR EMPLOYEES OF THE LIGHTHOUSE SERVICE DURING THE FISCAL YEAR 1920—Continued.

District.	Vessel or employee rendering service.	Vessel, etc., aided.	Nature of assistance.
5th	G. M. Wible, keeper; William S. Holland, assistant keeper, Tangier Sound Light Station, Va.	Yacht.....	Assistance rendered grounded yacht with three persons on board.
	W. J. Tate, keeper, North Landing River, etc., Aids, N. C.	Motor boat.....	Assistance rendered disabled motor boat.
	do.....	Gas freighter Taylor..	Assisted in raising the sunken gas freighter Taylor.
	John T. Twiford, keeper, Brant Island Shoal Light Station, N. C.	Motor boat.....	Assistance rendered disabled motor boat in sinking condition with two persons on board.
	G. M. Willis, sr., keeper, Point Lookout Light Station, Md.	.....	Saved three persons from drowning and recovered body of another person who had drowned.
	Tender Jessamine.....	Schooner Richmond..	Found schooner frozen in ice and towed it to Annapolis, Md.
	Tender Orchid.....	Oyster sloop Eden.....	Found sloop frozen in ice and towed it to clear water.
	Tender Maple.....	Schooner J. S. James..	Floated and towed to dock at Alexandria, Va., steamer which was ashore and ice bound.
	J. F. Peele, assistant keeper, Neuse River Light Station, N. C.	Motor yacht Tressie...	Assisted yacht, towed it to station and made repairs to engine.
	A. J. Jarvis, keeper, Upper Cedar Point Light Station, Va.	Government launch 1-9.	Assisted launch which had run aground near station.
	Tender Columbine.....	Motor boat, Anna May	Towed disabled motor boat to port.
	A. J. Jarvis, keeper, Upper Cedar Point Light Station, Va.	Steamer Col. J. E. Sawyer.	Assisted steamer which ran ashore in vicinity of station.
	6th	Yacht James C.....	Towed disabled yacht to light station landing, a distance of 22 miles.
	John Lindquist, keeper; R. Heiser, first assistant keeper, Mosquito Inlet Light Station, Fla.	Hydroplane.....	Towed disabled machine 10 miles to light station landing and assisted the two occupants in making repairs.
6th	do.....	Launch.....	Towed to safe anchorage disabled launch with three revenue officers and one prisoner on board.
	Thomas Knight, keeper; J. E. Powell, first assistant keeper, Hillsboro Inlet Light Station, Fla.	Seaplane.....	Reported fall of seaplane to authorities and assisted in locating wrecked machine and with moving the bodies of the three men killed.
	do.....	Motor boat May.....	Assisted in repairing disabled boat, and towed it to safe anchorage.
	Thomas Knight, keeper, Hillsboro Inlet Light Station, Fla., and his two sons.	Yacht Genessee.....	Pulled yacht aground in St. Johns River, Fla., to deep water.
	Tender Mangrove.....	S. S. Algenib.....	Assisted in floating vessel aground in Charleston Harbor.
	Tender Cypress.....	Hydroplane.....	Assisted in beaching disabled machine and supplied food and shelter to two occupants.
	C. P. Houeywell, keeper, Cape Canaveral Light Station, Fla.	S. S. Bolino, U. S. Shipping Board.	Recovered anchor and chain slipped in Charleston Harbor and delivered same to agents.
	Tender Cypress.....	.....	Recovered anchor and chain lost by unknown vessel.
	do.....	S. S. Niceto de Larri- naga.	Assisted in floating steamer which had grounded.
	do.....	Yacht Hunter....,	Piloted yacht to McClellanville, S. C., to secure medical attention for injured child.
	A. F. Wichmann, keeper, Cape Romain Light Station, S. C.	Power boat Wallie A. Silsbie.	Assisted in raising and repairing boat sunk 15 miles from station, and furnished lodging to five occupants.
	A. F. Wichmann, keeper; L. R. Munn, first assistant keeper, Cape Romain Light Station, S. C.	Yacht Inwood.....	Rescued two ladies and three men from sinking yacht. Towed yacht to station and assisted in making repairs.
	7th	S. S. Mascotte, P. & O. S. S. Co.	Assisted in pulling ship off East Crawfish Shoal, Key West Harbor.
	H. P. Weatherford, keeper; Richard Palmer, first assistant keeper; James W. Marshall, second assistant keeper; Fowey Rocks Light Station, Fla.		
	Tender Ivy.....		

SAVING OF LIFE AND PROPERTY BY VESSELS OR EMPLOYEES OF THE LIGHTHOUSE SERVICE DURING THE FISCAL YEAR 1920—Continued.

District.	Vessel or employee rendering service.	Vessel, etc., aided.	Nature of assistance.
8th.....	John D. Balsillie, keeper; Robert L. Payne, first assistant keeper; Galveston Harbor Lights and Fog-Signal Station, Tex. Ollie K. Clayton, assistant keeper, Horn Island Light Station, Miss. Tender Sunflower.....	Sloop Edna.....	Rendered assistance to occupant of disabled sloop. Rescued a fisherman whose boat had capsized in the vicinity of Pascagoula River Entrance Light A, Miss. Transported about nine tons of provisions from Aransas Pass channel docks for storm sufferers.
	Ingvald C. M. Ericksen, first assistant keeper; Charles T. Hansen, assistant keeper; Sabine Bank Light Station, Tex. Archie E. Fox, assistant keeper, Halfmoon Reef Light Station, Tex. William H. Heinroth, keeper, Matagorda Light Station, Tex.		Maintained light after station had sustained serious damage during hurricane. Maintained light which was severely damaged during hurricane. During hurricane maintained light and took precautions which resulted in saving motor boat, and also cared for crew of Coast Guard Station.
	Thomas P. Roberts, keeper, Aransas Pass Light Station, Tex.		Assistant keeper of the Coast Guard Station at Port Aransas in relief work after hurricane.
	Leonard F. Edgecombe, keeper; S. Coludrovich, second assistant keeper; South Pass Range Rear Light Station, La.; William Hill, keeper, Calcasieu Range Light Station, La.; James P. Brooks, keeper; Philip E. Brooks, first assistant keeper; William H. Smith, second assistant keeper; Bolivar Point Light Station, Tex. Tender Camellia.....	Schooner Addison E. Bullard.	Rendered assistance to and cared for residents in vicinity of respective stations who had taken refuge in the station dwellings during the hurricane.
	Ralph Gordon, depot keeper, Port Eads, La.	.....do.....	Rendered assistance to schooner on fire at the mouth of South Pass, Mississippi River. Rendered assistance to the wife of the captain of schooner which was afire and cared for personal property of the captain.
	John D. Balsillie, keeper, Galveston Harbor Lights and Fog-Signal Station, Tex. Tender Sunflower.....	Launch Helois, Texas & Gulf S. S. Co., owners. Motor boat Clifton.....	Towed disabled launch, which had been aground, about 6½ miles. Rendered assistance to motor boat and towed it from Galveston Bar to Galveston Harbor.
	George W. Anderson, keeper; A. E. Fox, assistant keeper; Halfmoon Reef Light Station, Tex...	Schooner Louise.....	Assisted in repairing schooner, which had run ashore on Halfmoon Reef, and furnished food and lodging to the captain.
	Thomas Zettwoch, keeper, West Rigolets Light Station, La. Sydney Gibbon, keeper; Charles A. Powell, assistant keeper; Mobile Channel Lights, Ala. Lawrence Larson, keeper; Dan Larson, assistant keeper; Gulfport Channel Lights, Miss.	Launch Irish..... Launch Puritan..... Launch.....	Rendered assistance to disabled launch with two men aboard. Rendered assistance to disabled launch with seven persons aboard. Rendered assistance to four occupants of disabled launch, belonging to the steamer Singleton Palmer.
	Harry Brouwer, keeper, Chefunete River Range Light Station, La..	S. S. Najelda.....	Towed disabled steamer, which had drifted into Lake Pontchartrain, to the mouth of Chefunete River.
9th.....	Tender Lilac.....	U. S. S. Sialia.....	Proceeded in search of S. S. Sialia, which was broken down at sea in the vicinity of Providence Channel.
	.....do.....	U. S. S. May.....	Proceeded to and stood by U. S. S. May, which went aground on Point Engallo, Santo Domingo.
	.....do.....	U. S. A. T. Northern Pacific.	Rendered assistance to the U. S. A. T. Northern Pacific, which went aground on Colinas Shoal at the entrance of San Juan Harbor.

SAVING OF LIFE AND PROPERTY BY VESSELS OR EMPLOYEES OF THE LIGHTHOUSE SERVICE DURING THE FISCAL YEAR, 1920—Continued.

District.	Vessel or employee rendering service.	Vessel, etc., aided.	Nature of assistance.
5th.....	Simeon Martin, keeper, Culebrita Island Light Station, P. R.	.....	Rescued two men whose boat was wrecked on the reefs near Culebrita Island Light Station.
10th.....	Chancie Fitzmorris, keeper, West Sister Island Light Station, Ohio.	Power boat and house boat.	Rescued two men who were adrift in a disabled power boat for 36 hours.
	William L. Gordon, keeper, Green Island Light Station, Ohio.	Launch.....	Assisted disabled boat, towing same to Put-In-Bay.
11th.....	Otto Bufe, keeper, Grand Marais Harbor of Refuge Light Station, Mich.	Steamer Runnels.....	Aided in bringing survivors ashore from stranded vessel after severe hardships.
	Edward Lane, keeper, Michigan Island Light Station, Mich.	Tug Henry F. Brown, Schoeder Lumber Co., owner.	Aided stranded tug by passing a line from shore to vessel and took some of the men off the vessel.
12th.....	E. M. Wheaton, keeper, Milwaukee Pierhead Light Station, Wis.	Sail yacht.....	Rescued three men from capsized boat.
	Albert Van Velzen, assistant keeper, Chicago Pierhead Light Station, Ill.	.....	Rescued a man from drowning.
	Joseph Napeizinski, keeper; Ross F. Wright, first assistant keeper; Manitowoc Light Station, Wis.	.....	Rescued aviators from fallen plane.
	A. C. Ericksen, keeper, Little Traverse Light Station, Mich.	.....	Towed to shore boat with broken oar.
	H. R. Bavry, keeper; Julius Lonne, first assistant keeper; Wm. H. Nash, second assistant keeper; Wind Point Light Station, Wis.	Launch Vixon.....	Towed disabled launch to Racine.
	O. H. Knudsen, keeper, Cana Island Light Station, Wis.	Launch Frank O'Connor.	Rescued crew from burned vessel.
	F. A. Drew, keeper, Green Island Light Station, Wis.	Launch Helena.....	Towed disabled launch to Menominee.
16th.....	N. C. Monsen, keeper, Eldred Rock Light Station, Alaska.	Gas boat Chilkoot.....	Towed disabled boat 8 miles for repairs.
	Edmund Moore, keeper, Scotch Cap Light Station, Alaska.	Schooner Premier.....	Furnished food and lodging to two men and signaled boat to wireless for assistance for shipwrecked men.
	.....do.....	Barque Hecla.....	Gave shelter and food to 10 shipwrecked men.
	.....do.....	Power boat.....	Supplied two trappers with gasoline and provisions to take them to Unalaska. Boat became disabled and trappers returned to station, where they were furnished food and lodging from Apr. 8 to May 12.
	George Stinson, additional keeper, Mary Island Light Station, Alaska.	Gas boat Vanguard...	Assisted in floating boat which had gone ashore at Mary Island.
17th.....	George L. Lonholt, keeper, Patos Islands Light Station, Wash.	Launch Loretta.....	Towed disabled launch to safe anchorage.
	William S. Denning, keeper; Wyman T. Albee, assistant keeper; Robinson Point Light Station, Wash.	Gasoline tug Mayflower.	Towed disabled tug to safety.
	Bernard B. Meagher, keeper, Smith Island Light Station, Wash.	Launch Lucy Bell....	Rescued crew of three from launch which had burned and took them to mainland for medical attention.
	Tender Manzanita.....	Fishing schooner Flamingo, Peter Leisen, owner.	Pulled schooner off exposed rock and towed it to safe anchorage at Port Angeles, Wash.
	Jesse E. Thomas, keeper, Ediz Hook Light Station, Wash.	Motor boat.....	Rescued disabled boat which was drifting to seaward with owner aboard.
18th.....	J. F. Ingersoll, keeper; A. Martin, first assistant keeper; L. Jordan, second assistant keeper; M. Maxwell, third assistant keeper; Bonita Point Light Station, Calif.	Motor launch.....	Assisted in hauling motor launch off the rocks near the station.
	J. W. Astrom, keeper; H. C. Trotter, first assistant keeper; C. H. Livesay, second assistant keeper; Point Sur Light Station, Calif.	Motor boat.....	Assisted in rescuing two men in disabled motor boat.

DAMAGE BY COLLISIONS.

During the fiscal year there were 54 cases of collisions by vessels with aids to navigation, tenders and other lighthouse property, causing damages which have been repaired or paid for by the parties responsible therefor, or proper measures taken by the Lighthouse Service to compel payment by owners of the vessels where such owners or vessels were identified.

During the fiscal year four cases of collisions in which vessels of the Lighthouse Service were found to have been responsible for damage to other vessels or property were adjusted, in the total amount of \$362.85, and report will be submitted to Congress at the next session thereof under the provisions of section 4 of the act of June 17, 1910 (36 Stat. 537). One claim previously adjusted by the commissioner was appropriated for by Congress in the sum of \$150, by act of March 6, 1920. By act approved March 31, 1920, Congress appropriated \$2,759.80 to reimburse Frank S. Bowker, managing owner of schooner *W. H. Davenport* for damage done by the lighthouse tender *Azalea* in collision of October 2, 1899.

PUBLICATIONS OF THE LIGHTHOUSE SERVICE.

[Since Jan. 1, 1919, light lists and buoy lists have been sold.]

Publications.	Number distributed.	Date of last edition.	Cost of last edition.
Light lists:			
Atlantic and Gulf coasts of United States.....	3,374	Jan. 1, 1920	\$1,721
Pacific coast of United States, etc.....	2,347	.....do.....	830
Great Lakes of United States and Canada.....	834	Apr. 1, 1920	781
Upper Mississippi River and tributaries.....	360	Jan. 15, 1920	459
Ohio River and tributaries.....	738	Sept. 15, 1919	345
Lower Mississippi River and tributaries.....	1,041	Nov. 15, 1919	163
Buoy lists:			
First district.....	955	May 1, 1920	887
Second district.....	975	May 15, 1920	406
Third district.....	1,441	.....do.....	551
Fourth district.....	254	June 1, 1919	271
Fifth district.....	3,706	May 15, 1920	672
Sixth district.....	1,096	Mar. 1, 1920	898
Seventh district.....	881	Apr. 1, 1920	661
Eighth district.....	299	Sept. 1, 1918	653
Ninth district.....	239	Nov. 15, 1918	61
Tenth district.....	176	Apr. 1, 1919	276
Eleventh district.....	153	.....do.....	592
Twelfth district.....	128	.....do.....	325
Sixteenth district.....	1,121	June 1, 1920	267
Seventeenth district.....	695	.....do.....	327
Eighteenth district.....	724	.....do.....	258
Nineteenth district.....	1,097	Sept. 1, 1919	45
Miscellaneous publications:			
Weekly Notice to Mariners.....	216,000	1920	4,364
Poster Notice to Mariners.....	6,400	1920	81
Annual Report, Commissioner of Lighthouses.....	1,400	1919	674
Regulations for the United States Lighthouse Service.....	50	1918	619
Medical handbook.....	11	1915	633
Lighthouse Service bulletins.....	19,500	1920	276
Regulations for lighting bridges.....	244	1915	202
Regulations for uniforms.....	949	1920	79
Civil-service regulations.....	5	1913	73
Instructions for cost keeping.....	2	1914	170
Instructions to employees.....	11	1915	408
The United States Lighthouse Service.....	99	1915	508

Total number of publications sold in fiscal year 1920, 8,361. Total receipts from sales, \$1,652.25. The number of publications sold in the last six months of the fiscal year 1919 was 2,137, and this number was not included in the annual report for 1919, page 64.

COST OF PRINTING FOR LIGHTHOUSE SERVICE, FISCAL YEAR 1920.

Light lists.....	\$4,302.71
Buoy lists.....	5,385.45
Notices to mariners.....	4,452.00
Annual report.....	674.44
Specifications and other publications.....	303.22
Forms, reports, record books, etc.....	5,559.44
Total.....	20,677.26

MISCELLANEOUS RECEIPTS.

The following amounts were received by the Lighthouse Service during the year and turned into the Treasury: From sales of property, \$13,308.62; from damages to aids to navigation and other property, \$2,492.14; from leases and rentals, \$6,016.54; from collections on commercial radiograms, \$2.96; total, \$21,820.26.

APPROPRIATIONS FOR THE BUREAU OF LIGHTHOUSES AND THE LIGHTHOUSE SERVICE, SIXTY-SIXTH CONGRESS, FIRST AND SECOND SESSIONS, 1919-20, NOT LISTED IN PREVIOUS ANNUAL REPORT.

Title.	Act.	Amount.
Maintenance.		
Salaries, Bureau of Lighthouses, 1921.....	Legislative, May 29, 1920.	\$87,290
General expenses, Lighthouse Service, 1921.....	Sundry civil, June 5, 1920.	4,200,000
Salaries of keepers of lighthouses, 1921.....	do.	1,300,000
Salaries, lighthouse vessels, 1921.....	do.	1,800,000
Salaries, Lighthouse Service, 1921.....	do.	400,000
Retired pay, Lighthouse Service, 1921.....	do.	70,000
Total.....		7,837,290
Special Works.		
Vessels for Lighthouse Service.....	Deficiency, Nov. 4, 1919.	760,000
Diamond Shoal Light Vessel, N. C.....	do.	450,000
Aids to navigation, Comacott Harbor, Ohio.....	do.	19,600
Depot for sixteenth lighthouse district.....	Deficiency, Mar. 6, 1920.	12,000
Repairing and rebuilding aids to navigation, seventh and eighth lighthouse districts.....	do.	125,000
Total.....		1,366,600
Grand total.....		9,203,890

EXPENDITURES DURING THE FISCAL YEAR 1920 FROM APPROPRIATIONS FOR THE LIGHTHOUSE SERVICE

[Obligations incurred are not included.]

Salaries:	
Bureau of Lighthouses, 1919.....	\$4,947.75
Bureau of Lighthouses, 1920.....	56,916.59
Salaries of keepers of lighthouses:	
1918.....	231.66
1919.....	61,855.83
1920.....	1,241,662.84
Salaries, lighthouse vessels:	
1918.....	444.09
1919.....	81,795.81
1920.....	1,685,705.75
Salaries, Lighthouse Service:	
1919.....	4,435.14
1920.....	378,221.29
General expenses, Lighthouse Service:	
1918.....	86,750.70
1919.....	1,199,515.43
1920.....	3,062,189.19
Increase of compensation, Department of Commerce:	
1918.....	4.65
1919.....	14,954.56
1920.....	652,238.77
Retired pay, Lighthouse Service:	
1919.....	458.34
1920.....	50,963.75
Total maintenance.....	8,583,292.14

SPECIAL WORKS.

General:

Repairing and rebuilding aids to navigation, Atlantic coast.....	\$150,701.81
Light vessels for general service.....	18,085.83
Light vessels for general lake service.....	90,286.80
Radio installations on lighthouse tenders.....	21,504.17
Oil houses for light stations.....	144.12
Repairing and rebuilding aids to navigation, seventh and eighth lighthouse districts.....	2,672.25
Vessels for lighthouse service.....	952.94
Light-keepers' dwellings.....	2,853.20

First district:

Dog Island Light, Me.....	6.65
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Second district:

Woods Hole Lighthouse Depot, Mass.....	554.14
Nantucket Harbor Fog Signal, Mass.....	3,560.59
Depot for second lighthouse district.....	13,022.07

Third district:

Aids to navigation, Hudson River, N. Y.....	16,223.39
Tender for third lighthouse district.....	99.64
Aids to navigation, East River, N. Y.....	8,014.71
Great Salt Pond Light Station, R. I.....	18,686.93
Execution Rocks Light Station, N. Y.....	596.90
Staten Island Lighthouse Depot, N. Y. (wharves).....	23,089.30
Staten Island Lighthouse Depot, N. Y. (office).....	11,802.21
Ambrose Channel lighted buoys, N. J.....	25,743.80
Riprap protection for light stations, third lighthouse district.....	60.72
National security and defense, Department of Commerce, 1919 (Tompkinsville).....	91,435.48

Fourth district:

Joe Flogger Shoal Light Station, Delaware River.....	22,093.28
Aids to navigation, Delaware River, Pa. and Del.....	22,515.82

Fifth district:

Thimble Shoal Light Station, Va.....	1,509.44
Lighting Norfolk Harbor, Va.....	34.72
Cape Charles Light Vessel, Va.....	99.62
Aids to navigation, Cape Charles City, Va.....	9,122.69
Aids to navigation, Chesapeake Bay, Md. and Va.....	3,794.67
Diamond Shoal Light Vessel, N. C.....	324.12
Fifth lighthouse district gas buoys.....	49,078.32

Sixth district:

Aids to navigation, St. Johns River, Fla.....	4,866.21
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Seventh district:

Aids to navigation, Florida Reefs, Fla.....	35.56
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Eighth district:

Southwest Pass Light Vessel, Mississippi River.....	44.00
Aids to navigation, Atchafalaya Entrance Channel, La.....	7,086.46
Repairing and rebuilding aids to navigation, Gulf of Mexico.....	56,036.26
Aids to navigation, Mississippi River, La.....	18,036.62
Tender and barge, eighth lighthouse district.....	10.50
National security and defense, Department of Commerce (Caribbean Sea).....	9,640.67
Aransas Pass Light Station, Tex.....	9,490.00
Sand Island Light Station, Ala.....	9.42

Ninth district:

Aids to navigation, Guantanamo Bay, Cuba.....	11,606.13
Navassa Island Light Station, West Indies.....	2.21
Point Borinquen Light Station, Porto Rico.....	43,657.13
Point Jiguero Light Station, Porto Rico.....	235.65

Tenth district:

Aids to navigation, Conneaut Harbor, Ohio.....	20,312.93
Aids to navigation, Toledo Harbor, Ohio.....	376.08
Aids to navigation, Huron Harbor, Ohio.....	570.88
Aids to navigation, Fairport Harbor, Ohio.....	10,589.52

Eleventh district:

Detroit River Lights, Mich.....	\$14. 40
Aids to navigation, Fighting Island Channel, Detroit River, Mich.....	3, 408. 42
Sand Hills Light Station, Mich.....	841. 02
Aids to navigation, Keweenaw Waterway, Mich.....	31, 509. 42
Detroit Lighthouse Depot, Mich.....	33, 464. 61
Aids to navigation, St. Marys River, Mich.....	27, 637. 26

Twelfth district:

White Shoal Light Station, Mich.....	351. 83
Chicago Harbor Light Station, Ill.....	3, 894. 22
Manitowoc Breakwater Light Station, Wis.....	6, 256. 43
Aids to navigation, Indiana Harbor, Ind.....	2, 245. 40

Sixteenth district:

Aids to navigation, Alaska.....	36, 728. 87
Depot for sixteenth lighthouse district.....	49, 428. 68

Seventeenth district:

Kellett Bluff Light Station, Wash.....	909. 50
Aids to navigation, Coquille River, Oreg.....	4. 01
Aids to navigation, Washington and Oregon.....	8, 247. 58

Nineteenth district:

Aids to navigation, Pearl Harbor, Hawaii.....	283. 05
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Total, special works..... 1, 006, 501. 26

Total, maintenance appropriations..... 8, 583, 292. 14

Total, special works..... 1, 006, 501. 26

Grand total..... 9, 589, 793. 40

ITEMIZED ESTIMATES OF APPROPRIATIONS FOR THE FISCAL YEAR 1922, AND ITEMIZED STATEMENT OF EXPENDITURES FOR THE FISCAL YEAR 1920, AS REQUIRED BY THE ACT OF CONGRESS APPROVED JUNE 25, 1910 (36 STAT., 755).

[The expenditures herein stated are in part estimated, owing to the fact that all obligations incurred for the year 1920 have not yet been settled. Articles of supplies purchased for general stock have also been distributed, approximately, to features to be benefited. This table refers to appropriations made in the sundry civil appropriation act and does not include Bureau salaries in Washington nor the cost of publications, otherwise provided for. This statement contains also amounts for salaries and wages under certain items which are shown separately in the Book of Estimates, 1922.]

Item.	Estimate, 1922.	Expenditures, 1920.	Item.	Estimate, 1922.	Expenditures, 1920.
GENERAL EXPENSES, LIGHTHOUSE SERVICE.			GENERAL EXPENSES, LIGHTHOUSE SERVICE—contd.		
Lights and fog signals.			Buoys:		
Rations and provisions.....	\$135,000	\$245,657	Establishment.....	\$250,000	\$185,031
Fuel and test for keeper.....	95,000	87,362	Supplies.....	60,000	49,637
General supplies.....	350,000	295,639	Repairs.....	75,000	72,270
Repairs and improvements, including grounds and outbuildings.....	610,000	342,454	Incidental expenses.....		
Establishing lights and fog signals, including sites.....	40,000	39,499	Tenders:		
Necessary additional land for light stations.....	1,500	153	Rations and provisions.....	345,000	313,750
Outpost outboard houses.....	4,000	1,583	Supplies.....	725,000	615,871
Incidental expenses.....	7,900	6,592	Repairs.....	155,000	127,843
Day marks and spar buoys.			Incidental expenses.....	15,000	14,924
Establishment, including sites.....	2,500	1,608	Light vessels:		
Repairs and improvements.....	5,000	3,483	Rations and provisions.....	165,000	131,298
Incidental expenses.....	100	145	Supplies.....	200,000	162,310
Fog buoys.			Repairs.....	260,000	140,679
Establishment.....	4,000	3,318	Incidental expenses.....	2,450	2,775
Wages of laborers attending buoys.....	918,000	250,221	Depots:		
Supplies.....	35,000	31,005	Pay of laborers and mechanics.....	220,000	182,047
Repairs and improvements.....	25,000	17,775	Rent.....	5,500	5,500
Incidental expenses.....	1,500	1,078	Supplies.....	85,000	74,907
			Repairs and improvements.....	105,000	95,420
			Incidental expenses.....	20,000	21,850
			Offices:		
			Technical books and periodicals.....	400	315

ITEMIZED ESTIMATES OF APPROPRIATIONS FOR THE FISCAL YEAR 1921, ETC.—Contd.

Item.	Estimate, 1922.	Expenditures, 1920.	Item.	Estimate, 1922.	Expenditures, 1920.
GENERAL EXPENSES, LIGHTHOUSE SERVICE—contd.			SALARIES, LIGHTHOUSE VESSELS.		
Officers—Continued.			Salaries and wages, lighthouse tenders.....	\$1,469,135	\$1,170,032
Stationery and office supplies.....	\$35,000	\$30,057	Salaries and wages, light vessels.....	705,865	596,843
Telegraph and telephone.....	10,000	9,435	Total.....	2,175,000	1,767,475
Traveling expenses and mileage.....	40,000	32,296			
Rent.....	2,750	2,750	Appropriation, 1921.....	\$1,800,000	
Freight, expressage, and cartage.....	110,000	91,615	Appropriation, 1920.....	1,775,000	
Incidental expenses.....	5,000	4,105	SALARIES, LIGHTHOUSE SERVICE.		
Total.....	5,100,000	3,996,358	Salaries, authorized district office, technical and depot forces.....	500,000	381,564
Appropriation, 1921.....	\$4,200,000		Appropriation, 1921.....	\$400,000	
Appropriation, 1920.....	4,000,000		Appropriation, 1920.....	383,000	
SALARIES OF KEEPERS OF LIGHTHOUSES.			RETIRED PAY, LIGHTHOUSE SERVICE.		
Salaries of lighthouse keepers.....	1,590,000	1,286,225	Retirement pay.....	100,000	61,436
Appropriation, 1921.....	\$1,300,000		Appropriation, 1921.....	\$70,000	
Appropriation, 1920.....	1,300,000		Appropriation, 1920.....	65,000	

SUMMARY OF ESTIMATES OF APPROPRIATIONS FOR THE LIGHTHOUSE SERVICE FOR THE FISCAL YEAR 1922.

FOR GENERAL MAINTENANCE OF THE LIGHTHOUSE SERVICE.

Salaries, Bureau of Lighthouses.....	\$89,540
General expenses, Lighthouse Service.....	5,100,000
Salaries, Lighthouse Service.....	500,000
Salaries, keepers of lighthouses.....	1,590,000
Salaries, lighthouse vessels.....	2,175,000
Retired pay, Lighthouse Service.....	100,000
Total.....	9,554,540

FOR SPECIAL WORKS.

Group 1. Works urgently necessary for the safety or immediate needs of navigation and for the preservation of existing structures or equipment, for the full utilization of other public improvements, or for the efficient equipment of the Lighthouse Service:

1. Constructing or purchasing and equipping tenders and light-vessels.....	5,000,000
2. Lighthouse depot for fifth district, enlargement, improvement, or establishment of new depot.....	400,000
3. Delaware Bay entrance, improvement of aids to navigation.....	148,500
4. Cape Spencer, Alaska, establishment of light and fog-signal station.....	185,000
5. Hawaiian Islands Lighthouse Depot, construction and equipment.....	120,000
6. Lighthouse depot for seventh district, establishing.....	250,000
7. Potomac River, Md., aids to navigation.....	95,000
8. Newport, R. I., lighthouse depot.....	82,300
9. Lighthouse depot for eighth district, construction.....	132,750
10. Alaska, aids to navigation.....	125,000
11. Charleston, S. C., Lighthouse Depot, improvements.....	60,000
12. Detroit, Mich., Lighthouse Depot.....	50,000
13. Virgin Islands, West Indies, aids to navigation.....	50,000

Group 1—Continued.

14. Ludington, Mich., aids to navigation.....	\$75,000
15. Tampa Bay, Fla., aids to navigation.....	17,500
16. Goat Island, Calif., Lighthouse Depot, keepers' dwellings.....	18,000
17. Galveston Jetty, Tex., fog signal.....	6,500
18. Calumet Harbor, Ill., improvements.....	66,000
19. Depot for second lighthouse district, completion.....	140,000
20. San Juan, P. R., Lighthouse Depot, improvement.....	72,000
21. Ketchikan, Alaska, Lighthouse Depot, completion.....	80,000
22. California, aids to navigation.....	25,000
23. Lansing Shoal, Mich., establishment of light and fog-signal station.....	304,000
24. Florida coasts, aids to navigation.....	150,000
25. Goat Island, Calif., Lighthouse Depot, improvements.....	80,700
26. Sandusky Bay, Ohio, aids to navigation.....	126,000
27. Oswego Harbor, N. Y., aids to navigation.....	16,000
28. Detroit River, Mich., patrol boat.....	.....
Authorized by law.....	6,235,000
Not authorized.....	1,640,250
Total, group 1.....	<u>7,875,250</u>

Group 2. Works considered essential for the needs of navigation and the equipment of the Lighthouse Service, and which it is recommended be undertaken as resources permit, are submitted with estimate of cost. (These items have been selected from a much larger number of recommendations submitted by the superintendents of the lighthouse districts, and others.)

29. Fifth lighthouse district, additional buoys.....	44,600
30. Port Pinos Light Station, Calif., improvements.....	37,500
31. Woods Hole, Mass., Lighthouse Depot, improvements.....	18,000
32. Santa Barbara, Calif., Light Station, improvements.....	33,000
33. Portage Lake, Mich., establishment of light and fog-signal station, and improvement of aids.....	100,000
34. Cape Kumukahi, Hawaii, establishment of light.....	26,500
35. Grays Harbor, Wash., Light Station, improvements.....	20,000
36. Norfolk, Va., to Beaufort, N. C., inland waterway, aids to navigation.....	89,000
37. Tumbler Island, Me., establishment of light.....	5,800
38. Staten Island, N. Y., Lighthouse Depot, machine shop.....	30,000
39. Spectacle Reef, Mich., Light Station, improvements.....	22,000
40. Red Rock, Calif., establishment of fog signal.....	14,500
41. Port Real, P. R., establishment of light station.....	40,000
42. Nine Mile Point, Mich., establishment of light and fog-signal station.....	50,000
43. Sag Harbor, N. Y., improvements and establishment of new aids to navigation.....	58,500
44. Great Salt Pond, R. I., Light Station, completion.....	53,000
45. Fairport Harbor, Ohio, aids to navigation, completion.....	44,000
46. Two Rivers, Wis., improvements.....	7,400
47. Otter Island, Me., establishment of light.....	3,600
48. Second lighthouse district, riprap protection for light stations...	19,700
49. Cape Cod, Mass., Light Station, improvements.....	6,000
50. Charlotte, N. Y., Light Stations, improvements.....	49,500
51. Escanaba, Mich., Light Station, improvements.....	71,000
52. Michigan Island, Wis., establishment of light and fog-signal station.....	85,000
53. Kauhola Point, Hawaii, improvements.....	28,500
54. Ram Island, Me., establishment of light.....	6,000
55. Henderson Point, Me., establishment of light and fog signal.....	8,400
56. Lake Champlain, N. Y. and Vt., improvements.....	150,000
57. West Neebish Channel, St. Marys River, Mich., aids to navigation.....	65,000
58. Sturgeon Bay, Wis., aids to navigation.....	49,000
59. Thirteenth lighthouse district, storehouse.....	2,500
Total, group 2 (not included in total of estimates).....	<u>1,238,000</u>

RECAPITULATION.

For general maintenance of the Lighthouse Service.....	9,554,540
For special works, group 1.....	7,875,250
Total.....	<u>17,429,790</u>

DETAILED ESTIMATES FOR MAINTENANCE, 1922.

BUREAU OF LIGHTHOUSES.

Salaries..... \$89,540

GENERAL EXPENSES, LIGHTHOUSE SERVICE.

For supplies, repairs, maintenance, and incidental expenses of lighthouses and other lights, beacons, buoyage, fog signals, lighting of rivers heretofore authorized to be lighted, light vessels, other aids to navigation, and lighthouse tenders, including the establishment, repair, and improvement of beacons and day marks and purchase of land for same; the establishment of post lights, buoys, submarine signals, and fog signals; the establishment of oil or carbide houses not to exceed \$10,000: *Provided*, That any oil or carbide house erected hereunder shall not exceed \$1,000 in cost; the construction of necessary outbuildings at a cost not exceeding \$1,000 at any one light station in any fiscal year; the improvements of grounds and buildings connected with light stations and depots; restoring light stations and depots and buildings connected therewith: *Provided*, That such restoration shall be limited to the original purpose of the structures; wages of persons attending post lights; pay of temporary employees and field force while engaged on works of general repairs and maintenance and pay of laborers and mechanics at lighthouse depots; rations and provisions or commutation thereof for keepers of lighthouses, working parties in the field, officers and crews of light vessels and tenders, and officials and other authorized persons of the Lighthouse Service on duty on board of such tenders or vessels; and money accruing from commutation for rations and provisions for the above-named persons on board of tenders and light vessels or in working parties in the field may be paid on proper vouchers to the person having charge of the mess of such vessel or party; reimbursement under rules prescribed by the Secretary of Commerce of keepers of light stations and masters of light vessels and of lighthouse tenders for rations and provisions and clothing furnished shipwrecked persons who may be temporarily provided for by them, not exceeding in all \$5,000 in any fiscal year; fuel and rent of quarters, or commutation thereof, where necessary for keepers of lighthouses; the purchase of land sites for fog signals; the rent of necessary ground for all such lights and beacons as are for temporary use or to mark changeable channels and which in consequence can not be made permanent; the rent of offices, depots, and wharves; traveling expenses, mileage, library books for light stations and vessels, and technical books and periodicals not exceeding \$1,000; traveling and subsistence expenses of teachers while actually employed by States or private persons to instruct the children of keepers of lighthouses; and for all other contingent expenses of district offices and depots and not exceeding \$11,500 for contingent expenses of the Office of the Bureau of Lighthouses in the District of Columbia, \$5,100,000.

Hereafter every lighthouse keeper and assistant keeper in the Lighthouse Service of the United States shall be entitled to receive one ration per day, or, in the discretion of the Commissioner of Lighthouses, commutation thereof at the rate of 80 cents per ration.

NOTE.—The amount estimated is an increase of \$900,000 over the appropriation for the fiscal year 1921, but this latter appropriation will not be sufficient to reasonably maintain the Service. The increase is essential to meet the continued great rise in the cost of labor and supplies, to make good deterioration in the structures, vessels, and property of the Lighthouse Service and deficiencies in supplies due to war-time conditions, and insufficiency of appropriations, and to care for the increased number of aids to navigation necessary for the safeguarding of commerce. Some of the principal items of increased costs are:

Bituminous coal, 50,000 tons, increase \$1.....	\$200,000
Anthracite coal, 9,000 tons, increase \$2.....	18,000
Kerosene, 600,000 gallons, increase 3 cents.....	18,000
Subsistence on vessels, increase 10 cents a day.....	60,000
Subsistence of keepers, increase to 80 cents a day.....	192,000
Increased compensation of labor on construction and repair work.....	100,000
Increased compensation for lamplighters in river districts, because of increased cost of operating their boats.....	20,000
Freight and travel increase due to rates authorized in August, 1920.....	31,000
Maintenance of new systems of aids to navigation at Pearl Harbor, and anchorage buoys required by act of June 5, 1920.....	35,000
Equipment of lighthouses at entrances to principal ports with radio fog signals.....	100,000

A considerable sum will be required to make good deficiencies in upkeep of stations, vessels, property, and stocks of supplies.

There was an increase during the fiscal year 1920 of 256 in the number of aids to navigation maintained, the total on June 30, 1920, being 16,324. In order to keep pace with the constant development of commerce and shipping, it is important that proper provision be made for the maintenance and repair of the

present system of aids to navigation, and for the establishment of necessary additional minor aids demanded from time to time by the growth of commerce.

Modifications in the language of the above appropriation are submitted to provide for an increase in the limit of cost of oil or carbide houses and outbuildings at light stations from \$550 and \$500, respectively, to \$1,000. This is necessary on account of the increased cost of construction, as it is practically impossible to build suitable structures for these purposes within the limits of cost now authorized. Provision is also included for commutation of fuel and rent of quarters for keepers of lighthouses. Authority is contained in the present law for the payment for fuel and rent of quarters, but there are some cases of isolated lights, where the Government owns no dwelling and no quarters are available for renting in the locality. In such cases it is more advantageous and economical for the Government to commute the value of quarters and fuel and authority therefor is accordingly requested.

(See p. 64 for itemized estimate.)

Authority is also requested for an increase in the ration allowance of lighthouse keepers and assistant keepers, or communication therefor, from 45 cents per day, as authorized in the act of June 20, 1918 (40 Stat., 608), to 80 cents per day. This amount is considered to be the minimum for which subsistence can be provided at the present cost of food supplies, and is the lowest rate now in force for the crews of lighthouse tenders and light vessels.

Salaries, keepers of lighthouses.—For salaries of not exceeding 1,800 lighthouse and fog-signal keepers and persons attending other lights, exclusive of post lights, \$1,590,000.

Hereafter the average salary of lighthouse keepers and assistant lighthouse keepers shall not exceed \$960 per annum, provided that in addition thereto lighthouse keepers shall receive an increase at the rate of \$5 per month after 5 years of continuous service, and at the rate of \$10 per month after 10 years' continuous service.

NOTE.—This estimate is an increase of \$290,000 over the appropriation for the fiscal year 1921, and is arrived at as follows:

1,500 keepers and assistant keepers at average pay of \$1,140.....	\$1,440,000
Persons attending other lights	96,360
Increase for persons attending other lights.....	14,454
Longevity pay on above basis.....	67,320
Total	1,618,134

Under Revised Statutes 4673, as amended by the act of June 20, 1918 (40 Stat. 609), the Secretary of Commerce is authorized to regulate the salaries of keepers of lighthouses at an average of not exceeding \$840 per keeper. Such regulation of salaries has been made, the present average for keepers and assistant keepers being approximately \$840. In addition thereto these employees have received the bonus as authorized by Congress, making the total average pay received approximately \$1,100 during the fiscal year 1920. It is the opinion of the Bureau that an additional \$120 is necessary for a just rate of compensation under present conditions and it therefore recommends that the law be amended as above, the rate of \$960 being exclusive of any bonus and based on the assumption that a bonus equal to that now authorized will be continued.

Recommendation is further made for the additional provision of law as above, for a system of longevity pay for lighthouse keepers, in order that there may be greater incentive to enter and remain in the Service and suitable reward for faithful and continuous performance of duty; it is considered that this will greatly improve the personnel at the light stations.

It is very important for the proper maintenance of the Service that the compensation of persons attending other lights be increased, because of general living conditions, the increased expense to these light attendants of furnishing their own boats and gasoline, and the fact that they have not had the benefit of the bonus, or other increases proportionate to the lightkeepers and others, and an estimate of \$14,454 is included for this purpose.

(See p. 65 for itemized estimates.)

Salaries, lighthouse vessels.—For salaries and wages of officers and crews of light vessels and lighthouse tenders, including temporary employment when necessary, \$2,175,000.

NOTE.—The amount estimated is \$375,000 more than the appropriation for the fiscal year 1921, and is arrived at as follows:

Authorized base pay, September, 1920.....	\$1,944,117
Further increase necessary to more nearly meet Shipping Board scale for officers, 497 officers at average of \$300.....	149,100
Further increases for crews.....	19,495
Longevity pay for unappointed men, at \$5 per month after six months' continuous service and \$10 per month after two years' continuous service (estimated 692 men at average of \$7.50 per month).....	62,288
Total.....	2,175,000

There continues to be great difficulty in maintaining the personnel on vessels of this Service, owing to disparities in pay, and demand for men to man the shipping of the country. The above estimates are considered essential for the maintenance of the vessels of the Service. There is a large loss in attempting to operate vessels with insufficient or incompetent crews.

(See p. 65 for itemized estimate.)

Salaries, Lighthouse Service.—For salaries of 17 lighthouse superintendents, and of clerks and other authorized permanent employees in the district offices and depots of the Lighthouse Service, exclusive of those regularly employed in the office of the Bureau of Lighthouses, District of Columbia, \$500,000.

Hereafter the salary of the superintendent of the third lighthouse district shall be \$5,000 per annum, and the salaries of superintendents of lighthouses of the other districts, excepting Army Engineers where so designated, shall be \$4,500 per annum.

NOTE.—An increase of \$100,000 over the appropriation for the fiscal year 1921 is submitted, consisting of the following:

Increase in the compensation of superintendents of lighthouses, authorization requested; 16 superintendents, at \$1,500 each and 1 at \$1,400.....	\$25,400
Proposed increases in the pay of district employees in order to meet the general advance in compensation, 240 persons, at an average of \$270 each, exclusive of bonus where now paid.....	64,700
Longevity pay, at rates to be established.....	9,900
Total.....	100,000

The district superintendents of lighthouses are at present greatly underpaid, in comparison with technical positions of similar responsibility in other branches of the Government and outside, and also in comparison with employees under their direction, many of whom are now receiving the same or greater compensation; a fair compensation for the district superintendents is extremely important for the future welfare of the Lighthouse Service. Practically all of the district technical and clerical employees are underpaid, and for the efficient maintenance of the Service the above increases are essential.

(See p. 65 for itemized estimate.)

Retired pay, Lighthouse Service.—For retired pay of officers and employees in the field service and on vessels of the Lighthouse Service, except persons continuously employed in district offices and shops, \$100,000.

NOTE.—The act of June 20, 1918, provides: "That hereafter all officers and employees engaged in the field service or on vessels of the Lighthouse Service, except persons continuously employed in district offices or shops, who shall have reached the age of sixty-five years, after having been thirty years in the active service of the Government, may at their option be retired from further performance of duty, and all such officers and employees who shall have reached the age of seventy years shall be compulsorily retired from further performance of duty: *Provided*, That the annual compensation of persons so retired shall be a sum equal to one-fortieth of the average annual pay received for the last five years of service for each year of active service in the Lighthouse Service or in a department or branch of the Government having a retirement system, not to exceed in any case thirty-fortieths of such average annual pay received: *Provided further*, That such retirement pay shall not include any amount on account of subsistence or other allowance."

The amount required under this appropriation will necessarily increase gradually for a few years, as the number of persons annually becoming eligible to the benefit is greater than the number of retired employees who decess. The appropriation for 1919 was \$30,000, for 1920, \$65,000, for 1921, \$70,000, and \$100,000 is estimated for 1922. Eventually, however, the amount required will become practically stationary.

DETAILED ESTIMATES FOR SPECIAL WORKS, 1922.

GROUP NO. 1.

Works urgently necessary for the safety or immediate needs of navigation and for the preservation of existing structures or equipment, for the full utilization of other public improvements, or for the efficient equipment of the Lighthouse Service.

No. 1. *Lighthouse vessels, general service.*—Constructing or purchasing and equipping lighthouse tenders and light vessels for the Lighthouse Service, \$5,000,000.

NOTE.—The act of June 5, 1920 (Public No. 275, 66th Cong.), authorized this work, but no appropriation was made therefor. Careful estimates and examinations as to the condition and further serviceability of vessels of the Lighthouse Service, show that it is very necessary to take prompt measures for replacing the older and wornout vessels of the Service. Immediate provision should be made for 17 vessels covered by this item. This is considered indispensable, not only to the efficient operation of the Lighthouse Service in the protection of shipping, but for the reasonable safeguarding of the lives of those employed on vessels of this Service. The extent of the work required at this time is due to lack of sufficient appropriations for a number of years back, to keep up a proper rebuilding program, and to war conditions. Only one of the light vessels is for a new station, all the others being to replace vessels wornout in service.

In view of the time required to design, contract for, build, and complete vessels, the whole of this plan should be provided for at the earliest practicable date. A full statement of this important need was given in Appendix A, Report of the Secretary of Commerce for 1919:

3 tenders at \$400,000 each.....	\$1,200,000
1 tender for rivers.....	100,000
10 light vessels at \$335,000 each.....	3,350,000
3 light vessels at \$160,000 each.....	480,000
Total.....	5,130,000

No. 2. *Depot for fifth lighthouse district.*—Enlarging and improving the lighthouse depot at Portsmouth, Va., in the fifth lighthouse district, or establishing a new depot, \$400,000.

NOTE.—The act of June 20, 1918 (40 Stat., 607), authorized this work at \$275,000, but no appropriation was made therefor. The present lighthouse depot at Portsmouth, Va., is entirely inadequate to the needs of the fifth district, both in area and in water front. This depot is the principal supply station for the lighthouse work of Chesapeake Bay and the coast from Maryland to North Carolina, with the sounds and rivers. The increasing maritime and naval importance of the vicinity of Norfolk makes it urgent that a suitable depot be established promptly. It is the principal depot of one of the largest lighthouse districts, and is the headquarters for six tenders and two light vessels during the greater part of the year. The aggregate length of these vessels is over 1,400 feet; the total wharf frontage is only 240 feet. The operation of tenders is much hampered by this limited frontage, the delay caused by waiting to discharge or receive

and building are not suitable for a lighthouse depot. The Lighthouse Service now has the necessary site for its proposed depot in the nineteenth district, consisting of water front with small wharf in Honolulu.

It is proposed to build the present wharf out to the 140-foot slip line and extend it to a total length of 250 feet, making a total area of about 20,750 square feet, 10,800 of which will be new reinforced-concrete wharf on piles. General storehouse, machine and repair shop and oil house to be located on this wharf. A depot keeper's dwelling to be erected as second story to storehouse. Detailed estimate:

Improvement and enlargement of former naval wharf, Honolulu:	
Excavation and fill, 1,000 cubic yards, at \$2.....	\$2,000
Retaining wall, reinforced concrete (1½ x 4), 155 linear feet, at \$8.....	1,240
Seawall, reinforced concrete (2½ x 8), 275 linear feet, at \$35.....	9,625
Water and waste pipe (furnish, lay, and cover), 600 linear feet, at \$2.25.....	1,350
Improvement old wharf, grading and concrete paving, 4,500 square feet, at 70 cents.....	3,150
New reinforced concrete wharf, on piles, 10,800 square feet, at \$3.75.....	40,500
General storehouse, reinforced concrete, 75,000 cubic feet, at 56 cents.....	42,000
Machine and blacksmith shop, reinforced concrete, 12,500 cubic feet, at 55 cents.....	6,875
Buoy repair and carpenter shop sheds, 2,500 square feet, at \$2.....	5,000
Equipment, general depot and buoy shed.....	1,500
Equipment, machine, carpenter, and blacksmith shop.....	4,510
Oil house, 7,500 cubic feet, at 30 cents.....	2,250
Total.....	120,000

No. 6. Depot for seventh lighthouse district.—Purchasing site for and constructing and equipping a lighthouse depot for the seventh lighthouse district, \$250,000.

NOTE.—The act of June 5, 1920 (Public No. 275—66th Congress), authorized this work but no appropriation was made therefor. The Lighthouse Service storehouse, wooden smithy, and wharf are on property belonging to the Treasury Department, which is situated in the midst of the United States naval station. The wooden storehouse and wharf, which are highly inflammable, are located between the Navy coal sheds and Piers A and B, one of each on each side and are, therefore, in an unusually dirty location. The coal dust is practically always in motion, and when the coal conveyors are in operation it blows about in clouds. It finds its way into the depot keeper's quarters and into the storehouse, where the thousands of dollars' worth of property is stored, which it is impossible to keep clean. These coal sheds have been erected since the storehouse was built. Furthermore, there are frequently several Navy torpedo-boat destroyers lying alongside at the Navy piers on each side of the depot wharf, which, in addition to causing a great deal of dirt, are a menace to the lighthouse tenders on account of collision. A new site and wharf are now urgently needed for the efficient and economical work of the district. The Navy Department has repeatedly urged the removal of this depot from its present location in the midst of the navy yard. Detailed estimate:

Site, waterfront property, about 100,000 square feet, at \$1.25 per square foot.....	\$125,000
Wharf, at \$2.15 per square foot (30 by 400 feet).....	25,800
Bulkheading, at \$30 per linear foot (400 by 27 by 1 foot).....	12,000
Service building, at 44 cents per cubic foot (70,000 cubic feet).....	30,800
Keeper's dwelling, at 37 cents per cubic foot (24,000 cubic feet).....	8,880
Storehouse, at 18 cents per cubic foot (144,000 cubic feet).....	25,920
Oilhouse, at 28 cents per cubic foot (8,000 cubic feet).....	2,240
Machine shop, at 19 cents per cubic foot (12,000 cubic feet).....	2,280
Carpenter shop, at 19 cents per cubic foot (12,000 cubic feet).....	2,280
Blacksmith shop, at 19 cents per cubic foot (12,000 cubic feet).....	2,280
Track on wharf, at \$1.80 per linear foot (2,400 linear feet).....	4,320
Buoy skids and chain platform, at \$1.50 per square foot (25 by 40 feet).....	1,500
Boundary fence, at \$3.50 per linear foot (680 linear feet).....	2,380
Water pipe (excavating, furnishing, laying, and covering), at \$1.55 per linear foot (280 linear feet).....	434
Shop equipment.....	3,886
Total.....	250,000

No. 7. Potomac River, Md., aids to navigation.—Improving the aids to navigation and establishing new aids on the Potomac River, Md., \$95,000.

NOTE.—The act of June 20, 1918 (40 Stat., 608), authorized this work, but no appropriation was made therefor. The Potomac River is the most poorly lighted and marked of the important navigable rivers of the United States, a condition which should not be allowed to continue, because of its relation to the National Capital and many Government activities, and its increased navigational importance. There are urgent requests from steamship companies for improvements in the lighting and marking of the Potomac River. The Potomac River, from Maryland Point to Washington, about 40 nautical miles, is now lighted by only four gas buoys, five minor lights, and one lighthouse. The gas buoys are of low candlepower and are of necessity removed from station for several months in the winter on account of ice conditions. The minor lights are all fixed white or red lights of low candlepower, located on wharves or on timber structures, which are liable to destruction by ice in the winter. Jones Point Light Station is of little use on account of changes in shore line at this point. It is proposed to establish nine lights, nine fog signals, move one light, change two fog signals from bells to horns, change two spar buoys to tall-type cans, replace one spar buoy with a bell buoy, establish a gas buoy and convert seven oil gas buoys to acetylene gas buoys. Jones Point Light Station and the five minor lights above mentioned may then be discontinued. Detailed estimate:

Site for 1 light station, 3 acres, at \$333.33.....	\$1,000
1 dwelling, 30 by 40 feet, frame, 14,286 cubic feet, at \$0.35 per cubic foot.....	5,000
6 light towers, frame, 20 feet high, 6,000 cubic feet, at \$0.30 per cubic foot.....	1,800
1 light tower, iron pipe, 25 feet high.....	710
2 fog-signal houses, 15 by 20 by 8 feet, brick, 4,800 cubic feet, at \$0.50 per cubic foot.....	2,400
6 fog-signal houses, at \$100 each.....	600
1 fog-signal tower, 2,000 cubic feet, at \$0.30 per cubic foot.....	600
Illuminating apparatus for 9 stations.....	4,750
Fog-signal apparatus for 11 stations.....	11,600
Transfer of one tower.....	100

Two light stations on caissons, cast iron filled with concrete:	
Steel-sheet submarine stations, 26,000 pounds, at \$0.25 per pound	\$6,500
Cast-iron submarine stations, 25,000 pounds, at \$0.15 per pound	3,750
Concrete submarine stations, 250 cubic yards, at \$35 per cubic yard	9,100
Piling, staging, erecting	5,300
Towers, hardware, etc.	850
Riprap, 1,000 tons, at \$15 per ton	15,000
Buoys, 2 tall cans, at \$500 each	1,000
Buoy, one gas	4,000
Buoy, one bell	1,200
Buoys, converting 7 oil gas to acetylene	13,837
Chain, sinkers, shackles, and swivels for buoys	2,903
Total	95,000

No. 8. *Newport, R. I., lighthouse depot.*—Purchasing site and building wharf and storehouse for new lighthouse depot in Narragansett Bay, same to be located at Newport, R. I., or vicinity, \$82,300.

NOTE.—This depot is used to supply the eastern end of the third lighthouse district, including Narragansett Bay. The present depot is located on the breakwater at Newport Harbor, which location is very unsatisfactory and inconvenient, as the water at the dock is too shoal for the larger tenders, and there are no facilities for tenders getting water, or having provisions, ice, etc., delivered, which necessitates the tenders going to Newport for provisions, etc., causing much waste of working hours. The Navy Department is building along the breakwater continuously, and the present plans of the Navy bring them down to the lighthouse depot. The present dock is in very bad condition, due to age, decay, and worming of piles, and at present is unsafe for further use. Improvement of the depot on the existing site is not considered economical, owing to lack of space and other conditions. Detailed estimate:

Site for new depot	\$40,000
Piling, 300 piles, at \$80 each	24,000
Concrete dock, 350 cubic yards, at \$30 per cubic yard	10,500
20,000 feet timber, at \$165 per 1,000 board feet	3,300
Storehouse, 15,000 cubic feet, at 30 cents per cubic foot	4,500
Total	82,300

No. 9. *Depot for eighth lighthouse district.*—Constructing and equipping a lighthouse depot for the eighth lighthouse district, at New Orleans, La., or vicinity, \$132,750.

NOTE.—The act of June 20, 1918 (40 Stat., 608), authorized this work in the sum of \$88,500, but no appropriation was made therefor. A lighthouse depot at New Orleans, La., is of great importance for the convenient and economical administration of the district. It should be at district headquarters, where supplies and materials are readily available and where shipments by rail and steamer could be received and accumulated for distribution by tender or other means at the proper time. The lamp shop should be located at this depot, as at present all intercourse with the mechanic in charge is by mail and telegraph, which is an inefficient method and the cause of numerous delays, and the present quarters are crowded, inadequate, and badly located. The stores and supplies, excluding buoys and appendages, should be under the eye of the superintendent at all times. The present depot at Port Eads, La., at the South Pass of the Mississippi River, is nearly 100 miles from district headquarters. A desirable site has been secured for the proposed depot, through a permit from the Treasury Department, to use a portion of the river frontage outside of the levee at the Marine Hospital, New Orleans, La. The great and continuing increase in the cost of labor and materials necessitates an increase over the original estimate for this project which was submitted in 1917. Detailed estimate:

Wharves on creosoted piles and stringers, at \$1.50 per square foot (60,000 square feet)	\$90,000
Steel shed on wharf, at \$1.50 per square foot (18,000 square feet)	27,000
Lamp shop, blacksmith shop, oil house, at 52½ cents per cubic foot (30,000 cubic feet)	15,750
Total	132,750

No. 10. *Aids to navigation, Alaska.*—Establishing new aids to navigation and for improvements to existing aids in Alaska, \$125,000.

NOTE.—An appropriation of \$75,000 was made by the act of July 19, 1919 (41 Stat., 213), for aids to navigation in Alaska, but practically all of this has been expended or obligated and maritime interests are urging that the system of lights and fog signals be further improved to facilitate and safeguard water transportation in Alaska, where navigation is exceptionally difficult and hazardous, as shown by the frequency of costly marine disasters occurring in these waters. The commerce of Alaska is increasing in volume and importance, and the fishing industry is being greatly expanded. A number of watched lights on shore or on reefs, and a few lighted buoys are needed to mark the principal routes of navigation through inside passages, and a number of requests have been received for new lights to mark the entrances to bays where new fish packing or other plants have been constructed and which have nor heretofore been ports of call for large steamers. A few unwatched lights are needed on the outside coast to mark headlands or entrances to harbors, for the benefit of coastwise traffic and fishing vessels. At Guard Island, an important station on the principal inside route, at the northwesterly end of Tongass Narrows, it is desired to replace the present unsatisfactory fog bell with an air diaphone and to construct a suitable permanent light and fog-signal building to replace present temporary wooden tower; also to erect another dwelling in order that two keepers may be assigned instead of one as at present, and thus provide for continuous day and night watches. At Point Retreat, an important station, there is now only an unwatched acetylene light and no fog signal. All regular vessels plying between southeastern and southwestern Alaska pass this point, either by way of Saginaw Channel or by way of Skagway and Lynn Canal. It is proposed to establish an air diaphone and assign keepers, a suitable structure to be erected for the light and fog signal, and an unused dwelling now at the station to be repaired and refurnished for the use of the keepers.

There are comparatively few fog signals in Alaska, and no additions have been made to the fog signals in southeastern Alaska in the past 14 years. On account of the great amount of stormy and foggy weather, the dangers to which vessels are exposed in these channels, and the scarcity of favorable anchorages, a number of powerful fog signals should be provided as early as practicable, and the effectiveness of some of the earlier fog signals should be improved, and this item provides for two of these.

The act approved June 5, 1920, Public 275, Sixty-sixth Congress authorized \$32,500 for improvements to aids to navigation in Alaska, including improving Point Retreat and Cape Hinchinbrook Light Station, but no appropriation was made therefor. Recently revised estimates indicate that the amount authorized will be insufficient to cover the cost of necessary improvements at Point Retreat. The estimates heretofore submitted for improvements to aids in Alaska contemplated doing the work at Point Retreat in conjunction with similar work at Guard Islands, the same equipment, organization, etc., to be used at both stations, thus reducing the cost of each. Furthermore since the estimates were revised in 1919 recent construction work in Alaska has shown that unit costs have increased materially over those on which such estimates were based. Detailed estimate:

Guard Islands Light Station:

Fog-signal building and light tower surmounting same, reinforced concrete with metal lantern, at \$2.15 per cubic foot (13,000 cubic feet).....	\$27,950
Dwelling for keeper, frame, one story and attic, with concrete foundation, at 44 cents per cubic foot (20,000 cubic feet).....	8,800
Lantern and illuminating apparatus, lot.....	2,750
Engines, compressors and accessories.....	2,500
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	42,000

Point Retreat:

Fog-signal building, and light tower surmounting same, reinforced concrete with metal lantern, at \$2.15 per cubic foot (13,000 cubic feet).....	27,950
Repairs to existing dwelling.....	4,000
Minor structures.....	2,000
Boats, 3, at \$600 average.....	1,800
Lantern and illuminating apparatus.....	2,750
Engines, compressors and accessories.....	2,500
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	41,000

Gas buoys, at \$5,100 (2).....	10,200
Automatic acetylene lights, at \$4,000 (2).....	8,000
Automatic acetylene lights, at \$2,000 (6).....	12,000
Automatic acetylene lights, at \$1,300 (6).....	7,800
Automatic acetylene lights, at \$800 (5).....	4,000
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	42,000

Total.....	125,000
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No. 11. *Charleston, S. C., Lighthouse Depot*.—Completing the lighthouse depot at Charleston, S. C., in the sixth lighthouse district. \$60,000.

NOTE.—The act of June 5, 1920 (Public No. 275, 66th Cong.) authorized this work but no appropriation was made therefor. The act of October 22, 1913 (38 Stat., 244), appropriated \$125,000 toward the purchase of a site and construction of a wharf and buildings and equipment, so far as funds might permit, for a depot for the sixth district. This entire appropriation has been expended, but all the necessary facilities have not been provided. The site itself cost \$60,000 and the wharf \$46,418. Further requirements to complete the depot include dwellings for keeper and assistant keeper, who are required to live on the reservation, additional filling, water and sewer systems, walks, roads, oil house, additional equipment, etc. A considerable portion of the grounds is now below or only slightly above high tide and should be filled to make it available for use. The wharf is overcrowded with spare buoys and buoys brought in for repairs. It is necessary for a portion of the ground adjacent to the wharf to be surfaced with concrete to provide a suitable storage space for these buoys. Without the completion of this project the district organization is inadequately equipped to efficiently perform its duties. Detailed estimate:

Filling and grading, at \$2.50 per cubic yard (4,000 cubic yards).....	\$10,000
Oil house—concrete pile foundation, at \$200 each (12 piles).....	2,400
Oil house proper (reinforced concrete), at 56.7 cents per cubic foot (10,700 cubic feet).....	6,062
Concrete area for storage of buoys and chain, at \$8.25 per square yard (1,800 square yards).....	14,850
Hard surface roads, concrete, at \$8.25 per square yard (1,600 square yards).....	13,200
Cement walks, at 50 cents per square foot (6,000 square feet).....	3,000
Brick and iron fence on pile foundation, extension of 40 feet, at \$20 per foot.....	800
Water pipe, installed 400 feet 5-inch cast iron, at \$3.00 per foot.....	1,100
Sewer pipe, installed 100 feet 4-inch cast iron, at \$2.50 per foot.....	250
One 20-ton platform scale in place.....	500
Keepers' dwelling; new roof, replastering walls, painting and repairs.....	3,000
Fire protection, sprinkler system for, main storehouse, 2,000 feet, at \$2 per foot.....	4,000
Contingencies.....	738
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Total.....	60,000

No. 12. *Lighthouse depot, Detroit, Mich.*—For completing the improvements to the Detroit Lighthouse Depot, \$50,000.

NOTE.—The act of July 1, 1918, appropriated \$53,000 for improvements at the lighthouse depot, but, on account of the great advance in cost of labor and materials, it is impracticable to complete the work estimated within the amount appropriated. It is estimated that \$34,500 additional is required to complete the work. The outer section of the wharf has been practically completed as well as the addition to the lamp shop building. All mechanical equipment for the latter is yet to be supplied. The entire inner section or causeway portion of the wharf is yet to be completed. It is very essential that this connecting portion of the wharf be completed at the earliest practicable date in order that the portion already completed may be fully utilized. It is also urgently necessary that dredging be done to give full depth of water over the basin area. Additional improvements to the depot, consisting of the construction of a retaining wall along Mount Elliott Avenue and the closing in of the present open buoy shed to serve as a fabricating shop for steel work, etc., should be carried out at the same time the dock work and equipment of lamp shop is done. Detailed estimate:

Wharf, 19,900 square feet, at \$3.30.....	\$65,670
Dredging, 3,400 cubic yards, at \$1.....	3,400
Mooring bollards, 9, at \$60.....	540
Steel track, 600 linear feet, at \$1.50.....	900

Water supply, electric work, etc.....	\$490
Lamp shop, 27,000 cubic feet, at 50 cents.....	13,500
Retaining wall, 500 linear feet, at \$5.....	2,500
Alterations to buoy shed for shop.....	2,500
Machinery and equipment.....	8,000
Contingencies.....	5,500

Total.....	103,000
Less appropriation made by act of July 1, 1918.....	53,000
Amount required.....	50,000

No. 13. *Virgin Islands, West Indies, aids to navigation*.—Establishing and improving aids to navigation in the Virgin Islands of the United States, and adjacent waters, West Indies, \$50,000.

NOTE.—The act of June 20, 1918 (40 Stat., 608), authorized this work, but no appropriation was made therefor. By Executive order of July 20, 1917, the lighthouse service in the Virgin Islands, West Indies, acquired by the United States by treaty from Denmark, was transferred to and placed under the jurisdiction of the United States Lighthouse Service. The aids to navigation in these islands are not extensive and will require additions and improvements to make the waters safe and to provide for increasing commerce. It is proposed to provide four unwatched gas lights, five new buoys, as well as additional aids as may be necessary after further study and developments, and to place existing lighthouse property in a good condition of repair. The Governor of the Virgin Islands, on July 15, 1919, wrote the Secretary of Commerce urging the importance of improvement of aids to navigation in the Virgin Islands. Detailed estimate:

4 unwatched lights, tower 25 feet high, at \$5,000 each.....	\$20,000
5 buoys with moorings, at \$1,000 each.....	5,000
Relief and spare equipment for lights and buoys.....	5,000
Repairs to existing property.....	10,000
Additional aids to navigation, as necessary.....	10,000
Total.....	50,000

No. 14. *Ludington, Mich., aids to navigation*.—Improving aids to navigation and establishing new aids at Ludington, Mich., \$75,000.

NOTE.—The act of June 5, 1920 (Public, No. 275, 66th Congress), authorized this work in the sum of \$50,000, but no appropriation was made therefor. Owing to increased costs, since the estimate on which that authorization was based was submitted, this amount is not now sufficient for the necessary work. The present location of the fog-signal station on the end of south pier is 1,500 feet inside of entrance to outer harbor. At present the actual entrance between the breakwaters must be found by feeling around in the fog. This subjects vessels to danger of striking the breakwater. The commerce of Ludington, which includes important car-ferry lines across Lake Michigan, is as important as any other port on the east shore of Lake Michigan, and as this port is very inadequately lighted now, this improvement is considered well warranted. It is proposed to establish a main light on the outer end of the north breakwater, with fog-signal apparatus, consisting of electrically-driven air compressor and compressed air fog signal with oil-engine reserve drive, and to discontinue the present steam fog signal in old wooden structure. Quarters for keepers are to be erected adjacent to the light, as it is unsafe to cross the harbor during the winter and when the ice is constantly broken up by car ferries. The present dangerous condition should be corrected as early as practicable. Detailed estimate:

North Breakwater (main light):

Reinforced-concrete foundation, approximately 24 by 24 feet by 20 inches high, 427 cubic yards, at \$30 per cubic yard.....	\$12,810
Steel tower, concrete lined, base 15 feet square, top 10 feet square, 40 feet high, 6,480 cubic feet, at \$1.25 per cubic foot.....	8,100
Cast-iron lantern house, 4th order.....	1,900
Fog-signal house, brick and tile, 18 by 33 by 14 feet, 8,500 cubic feet, at 60 cents per cubic foot..	5,100
Foundation for fog-signal house, 60 cubic yards concrete, at \$12 per cubic yard.....	720
Fog-signal apparatus.....	17,770
Illuminating apparatus—	
Fourth-order lens with electric light.....	2,500
Total for north breakwater.....	48,900

South pier—

Concrete foundation.....	600
31-foot steel tower.....	400
Total for south pier.....	1,000

North pier—

Concrete foundation, 30 cubic yards, at \$20 per cubic yard.....	600
31-foot skeleton steel tower.....	1,200
300-millimeter lens lantern and electric light.....	300
1,000-foot electric transmission pole line.....	500
Total for north pier.....	2,600

Keepers' dwelling—

New lot.....	500
Three-family house, tile and concrete, 45 by 40 by 30 feet, 54,000 feet, at 36 cents per cubic foot.....	19,500
Outbuildings.....	1,000
Sidewalks, grading, fences, shore, protection, etc.....	1,500
Total for keepers' dwelling.....	22,500

Grand total.....	75,000
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No. 15. *Tampa Bay, Fla., aids to navigation.*—Establishing and improving aids to navigation in Tampa Bay, Fla., \$17,500.

NOTE.—The act of June 5, 1920 (Public No. 275, 66th Congress), authorized this work, but no appropriation was made therefor. Tampa is an important seaport with a large and growing commerce by sea. Owing to shallow water in Tampa Bay, deep-draft vessels can reach the city from the Gulf only by means of several comparatively narrow dredged cuts. Provision has already been made for lighting all of the important cuts excepting Cut D, for which lights should be provided as soon as practicable, as large vessels must pass through this cut in order to reach Port Tampa. Detailed estimate:

Tower, structural steel, at 19 cents per pound (32,100 pounds), and cast iron, at 8.8 cents per pound (41,860 pounds).....	\$9,800
Reinforced-concrete piling, in place, at \$15.20 per cubic foot (125 cubic feet).....	1,900
Illuminating apparatus (including installation).....	5,800
Total.....	17,500

No. 16. *Depot keepers' dwellings, Goat Island, Calif.*—Construction of two dwellings, at the Goat Island Lighthouse Depot, Calif., \$18,000.

NOTE.—The act of June 5, 1920 (Public No. 275, 66th Congress), authorized this work in the sum of \$18,500, but no appropriation was made therefor. The present quarters at the Goat Island Lighthouse Depot, consisting of two old frame cottages located at the water's edge, are wholly inadequate to accommodate the depot force. There are no quarters available for the assistant depot keeper, mechanic, and skilled laborer, all of whom are required to make long journeys to and from San Francisco each day. On account of the position of Goat Island in the middle of San Francisco Bay, with no ferry accommodations except such as can be obtained by means of the Naval Training Station boats, it is essential that all employees at the depot should be housed on the lighthouse reservation, as they are unable to properly carry on their work under present conditions. Orders have recently been issued by the Navy Department to remove the Naval Training Station from Goat Island on account of inclement weather conditions, and it is probable that the present launch service to the island will be very seriously reduced in the near future with great detriment to the Lighthouse Service. Two dwellings are urgently required to be built on the high ground adjacent to the depot for the accommodation of the keeper and the mechanic in charge of the depot shops. Owing to increased costs since the estimate on which the above authorization was based was submitted, the amount authorized is not sufficient, and \$1,500 additional is estimated to be required. Detailed estimate:

Two dwellings for keepers, at \$0.275 per cubic foot (65,455 cubic feet).....	\$18,000
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No. 17. *Galveston Jetty, Tex., Light Station.*—Improving Galveston Jetty Light Station, Tex., \$6,500.

NOTE.—The act of June 5, 1920 (Public No. 275, 66th Congress), authorized this work, but no appropriation was made therefor. The original appropriations, June 11, 1896 (29 Stat., 417), and May 27, 1903 (35 Stat., 332), for this station are insufficient for the purchase and installation of a sufficiently powerful fog signal. The commerce of the port of Galveston has been steadily increasing, consisting especially of shipments of cotton, grain, flour, lumber, steel, and canned goods. For the first five months of the calendar year 1919 the value of foreign exports from this port, exclusive of shipments in bond and the coastwise trade, was \$131,997,109, and imports, \$7,137,929. Four million four hundred and ninety-nine thousand eight hundred and sixty-nine tons of freight were handled at this port in the year 1918, and an adequate fog signal is required to enable vessels to enter Galveston entrance during foggy weather. A fog signal has been urgently requested by the Galveston Commercial Association. It is recommended that a compressed-air fog signal be installed as soon as funds permit. Detailed estimate:

Fog-signal apparatus, in duplicate.....	\$5,000
Piping, valves, shafts, foundations, etc.....	800
Installation.....	600
Incidentals.....	100
Total.....	6,500

No. 18. *Calumet Harbor, Ill., aids to navigation.*—Improving aids to navigation in Calumet Harbor and improving Calumet Pierhead Light Station, Ill., \$66,000.

NOTE.—Calumet Harbor Light and Fog Signal Station is located at the outer end of the Calumet Harbor (South Chicago) Breakwater. It is a steel structure with brick lining, having a second story and roof of wooden frame construction. The building stands on a number of small concrete columns bedded into the stone filling of the timber crib breakwater. The timber superstructure of the breakwater is old and advanced in decay. In April, 1920, two very heavy northeasterly storms "shook up" the station so badly and "worked" underpinning so severely that the keepers became badly scared in regard to their safety. The United States engineers have begun the entire rebuilding of the timber superstructure of breakwater in concrete, and propose to rebuild the entire breakwater as fast as funds are made available. The breakwater has a length of about 6,600 feet.

Permanent repairs must be begun by the spring of 1921 if the station is to be made safe and kept in commission. Calumet Harbor is one of the most important on Lake Michigan, the arrivals and departures of vessels per year being about 2,300, having a net registered tonnage of over 9,000,000, value of receipts and shipments per year being about \$125,000,000. The importance of this commerce fully justifies maintaining the aids in most efficient condition. The fog signal is operated more hours than any other signal on Lake Michigan. The present equipment of oil engines and air siren is old, very noisy, and becoming obsolete and should be replaced in the near future by modern and more efficient equipment. It is proposed to construct a hollow, strongly reinforced, concrete foundation pier (providing a basement within same) having a height of about 15 feet above lake level, to stand in present site on the present underwater portion of timber cribs of the breakwater. A switch house to be built at the inner end of the breakwater and connected with station at outer end by electric power cable along top of breakwater. Duplicate diaphone fog signal and a submarine signal operated by electric power are to be installed. Electric light to be used for illumination of lens.

At Calumet Pierhead Light Station, where there is a small cast-iron tower equipped with oil light and hand-power fog bell and maintained by two keepers, it is proposed to install an electric-operated diaphone

and place electric light in lens, and to discontinue the services of the two keepers now employed at this station, the station then to be operated by remote electric control from the harbor station. Detailed estimate:

Calumet Harbor:

Moving present steel building.....	\$3,000
Removing old timber superstructure of breakwater, 30 by 100 by 6 feet high, 704 cubic yards, at \$5.....	3,520
Reinforced concrete hollow superstructure for breakwater, 30 by 100 by 6 feet high, 704 cubic yards, at \$25.....	17,600
Reinforced concrete foundation pier on top of above, 30 by 68 by 10 feet high, walls 24 inches thick, 206 cubic yards, at \$40.....	8,240
Repairing and altering old steel structure and frame second story and roof.....	5,000
Total for building (main).....	37,360
Steelswitch house on shore.....	300
Total for buildings.....	37,660
Fog-signal apparatus, including electric transmission.....	17,830
Submarine fog signal.....	3,000
Electric illuminating equipment in place, old lens.....	100
Total for Calumet Harbor.....	58,590
Calumet Pierhead (North) Light Station:	
Fog-signal apparatus, including transmission and installation.....	7,410
Total for project.....	66,000

No. 19. Depot for second lighthouse district.—Completing the construction and equipment of a lighthouse depot for the second lighthouse district, \$140,000.

NOTE.—The act of July 1, 1918 (40 Stat., 607), appropriating \$85,000 for constructing and equipping this lighthouse depot was based upon estimates made in 1911. The great advance in cost of building material and labor makes the appropriation inadequate for the purpose intended. The present lighthouse depot in the northern end of the second district is located on Lovells Island about 9 miles from Boston, and is on land belonging to the War Department and urgently required by them for military purposes. The transaction of the work in the northern end of second district is greatly handicapped and the duties of the tenders much increased by having the base of supplies located nearly an hour's steaming from Boston. The new depot at Chelsea should be properly equipped and the depot established there at the earliest practicable date. Detailed estimate:

Dredging, at \$1.09 per cubic yard (21,600 cubic yards).....	\$23,520
Retaining wall, at \$23 + per cubic yard (3,437 cubic yards).....	79,177
Wharf, at \$1.8122 per square foot (6,895 square feet).....	12,495
Filling and grading at \$4 per cubic yard (1,500 cubic yards).....	6,000
Service building, 35 by 80 feet, at \$0.46176 per cubic foot (110,000 cubic feet).....	50,791
Keeper's dwelling, 25 by 35 feet, at \$0.60 per cubic foot (17,500 cubic feet).....	10,500
Oil house, brick, 25 by 40 feet, \$0.4995 per cubic foot (10,000 cubic feet).....	4,995
Carpenter shop and storehouse, 30 by 60 feet, at \$0.75 per cubic foot (9,600 cubic feet).....	7,200
Buoy cleaning shed, 20 by 50 feet, at \$0.50 per cubic foot (8,000 cubic feet).....	4,000
Buoy skids, at \$0.75 per linear foot (1,000 linear feet).....	750
Chain platform, at \$2 per square foot (2,000 square feet).....	4,000
Boundary fence, at \$10 per linear foot (267 linear feet).....	2,670
Railroad, push cars, and motors.....	7,000
Electric welding set complete, and air compressor, etc.....	3,200
Water main, 3 inch cast-iron, excavating and laying, 500 feet, at \$5.....	2,500
Machine-shop equipment.....	2,800
Contingencies.....	3,399
Total.....	225,000
Less amount appropriated by act of July 1, 1918.....	85,000
Amount required.....	140,000

No. 20. San Juan Lighthouse Depot, San Juan, P. R.—Constructing a new wharf at the San Juan Lighthouse Depot, San Juan, P. R., \$72,000.

NOTE.—The present wharf at the depot is in dilapidated condition beyond repair. The decking and stringers have rotted to such an extent that the wharf is unsafe for storing buoys, and the greater part of the wharf is closed off so as to prevent men from getting injured by falling through the rotten planking. The piles have been destroyed by teredo, and except for temporary fenders the wharf offers no protection for vessels tied up to it. A new wharf is urgently needed. Detailed estimate:

18,000 square feet wharf area, at \$4 (concrete decking and piles).....	\$72,000
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No. 21. Ketchikan, Alaska, Lighthouse Depot.—Completing the lighthouse depot, at Ketchikan, Alaska, in the sixteenth district, \$80,000.

NOTE.—The act of July 1, 1918 (40 Stat., 686), appropriated \$90,000 for a lighthouse depot and the necessary equipment for the sixteenth lighthouse district. This appropriation was supplemented by an item of \$12,000 contained in the deficiency appropriation bill approved March 6, 1920 (41 Stat., 516). All funds appropriated have been obligated. A wharf has been completed and a reinforced concrete storehouse erected. The latter has been provided with a temporary roof and is being used. A permanent roof should be provided, however, and the building should be otherwise completed and fitted for the purpose intended by installation of partitions, fixtures, freight elevator, shelving, etc. Other buildings and equipment are needed in order to complete the depot and provide suitable facilities for handling stock and for carrying on the work of the station with dispatch and in an efficient and economical manner. A separate building is needed for carpenter shop, machine shop, and blacksmith shop. The grounds adjacent to the wharf and building should be graded and roads and pavements constructed. A

dwelling should be erected on the premises for the depot keeper, as the site is on the outskirts of the town where no living quarters are available for rental and the keeper can render greater service if he resides permanently on the grounds. Detailed estimate:

To complete storehouse.....	\$10,000
Shop building, including carpenter, lamp, blacksmith, and boat shops, at 11 cents per cubic foot (154,490 cubic feet).....	16,993
Depot keeper's dwelling, frame, with concrete foundation, at 35 cents per cubic foot (21,600 cubic feet).....	7,560
Minor structures, including coal shed, gravel bin, gasoline house, and garage, at 35 cents (3,500 cubic feet), 11 cents (8,100 cubic feet), and 6 cents (17,500 cubic feet) per cubic foot.....	3,166
Improvements to grounds, grading, and roadways at \$5 per linear foot (250 feet); concrete pavement at 30 cents per square foot (6,000 square feet); drains and water supply piping at \$2 per linear foot (800 feet).....	4,650
Boat ways at \$5 per foot (450 feet).....	2,250
Equipment for storehouse and wharf.....	25,400
Shop equipment.....	9,981
Total.....	80,000

No. 22. California, aids to navigation.—Establishing aids to navigation, California, \$25,000.

NOTE.—The act of June 5, 1920 (Public No. 275, 66th Congress), authorized this work, but no appropriation was made therefor. Numerous petitions have been received for lighting the channel between Point San Mateo and the mouth of Alviso Slough, San Francisco Bay. This waterway is the natural outlet for nearly all the produce of the extensive Santa Clara Valley, and the annual traffic has been greatly increased on account of the greatly increased demand for this produce. The present channel is narrow and winding and there are no aids to assist mariners in keeping off the shoals at night. Accidents and strandings are of frequent occurrence. Much of the traffic must be carried on at night to take advantage of the tides. Additional lights are urgently needed and should be established at once. Gas buoys should also be provided at Fort Ross and Point Buchon, on the coast of California; these are necessary for the protection of coastwise shipping. There is an urgent demand for a more suitable lighted buoy at Crescent City, Calif.; during the past year one vessel was lost and another damaged at this entrance. There is a heavy traffic in the north channel of Suisun Bay, and two additional lights and echo boards are necessary. Detailed estimate:

San Francisco Bay, Alviso Channel:	
Acetylene-lighted beacons, 3 at \$1,500 each.....	\$4,500
Acetylene-gas buoy, type "L".....	4,000
Coast of California:	
Gas and whistle buoys at Point Buchon and Fort Ross, 2 at \$5,000 each.....	10,000
Gas and bell buoy at Crescent City.....	4,500
Suisun Bay, 2 lights and echo boards, at \$1,000 each.....	2,000
Total.....	25,000

No. 23. Lansing Shoal, Mich., Light and Fog-Signal Station.—Establishing a light and fog-signal station at Lansing Shoal, Mich., \$304,000.

NOTE.—This dangerous shoal, which is now marked by a light vessel, is located at the most important point on the northerly passage to and from the Straits of Mackinac. Maritime interests are urgent in their requests for a better light and a more adequate fog signal, located on a fixed crib. The light vessel is compelled, by reason of ice conditions, to be off her station in the early spring and late fall. The important commerce through this passage, both before the light vessel has been placed on her station and after she is compelled to leave it in late fall, fully warrants that a permanent first-class light and fog signal, rather than a light vessel, be used in this passage. The annual traffic past Lansing Shoal averages not less than 25 to 30 million tons, which reduced to vessel passages on the basis of an average load of 5,000 tons, which is a fair average for traffic on Lake Michigan and Green Bay, would indicate the annual passage of approximately 5,000 vessels in this vicinity. The establishment of this fixed station will permit of the discontinuance of the Squaw Island fog signal and the substitution of an acetylene unattended light for the present Squaw Island Light Station, which will do away with the three keepers and make an annual saving in expense of some \$2,300.

A reinforced concrete foundation pier about 70 by 60 feet by 20 feet high, above water, resting on proper underwater substructure and supporting rectangular steel building, surmounted by third-order lantern house; plane to be about 60 feet above water, equipped with third-order lens and high-power fog signal and submarine bell. Detailed estimate:

Underwater substructure of stone-filled crib or pile construction, approximately 65 by 65 by 20 feet, 3,100 cubic yards, at \$30 per cubic yard.....	\$93,000
Stone riprap about crib, 5,000 tons, at \$3.....	15,000
Reinforced concrete crib superstructure (hollow) 65 by 65 by 20 feet, 2,300 cubic yards, at \$40 per cubic yard.....	92,000
Steel or concrete building about 35 by 35 by 40 feet high (three storied), 48,000 cubic feet, at \$1 per cubic foot.....	48,000
Third-order lantern house.....	10,000
Heating and plumbing.....	3,000
Fog-signal apparatus, including submarine bell.....	15,000
Third-order lens and apparatus for illumination of same.....	10,000
Motor boat and other boats.....	5,000
Boat cranes at \$2,500 (4).....	10,000
Furniture and miscellaneous equipment.....	3,000
Total.....	304,000

No. 24. *Florida coasts, aid to navigation.*—Improving aids to navigation and establishing new aids on the coasts of Florida, and in the approaches to Key West, Fla.. \$150,000.

NOTE.—The type of structure for beacons marking the Florida Reefs was established many years ago and does not satisfactorily meet existing requirements. These beacons are usually destroyed by every hurricane that passes over them; 12 of them, every one in its path, were destroyed by the last hurricane (Sept. 9-10, 1919), and the others are in bad condition of repairs as well as structurally weak; and it is expected that they will be destroyed by the first severe storm that strikes the section of reefs where they are located. These are among the most important minor aids to navigation in the world and assist in marking the Florida Reefs for a distance of 135 miles, along which a large number of vessels, with valuable cargoes continually pass.

Key West is now one of the largest and most important seaports in the United States; it is Florida's greatest seaport, and its exports now amount to over \$80,000,000 per annum and its imports are over \$8,000,000, more than twice as great as those of all of the other Florida ports combined, and it is increasing steadily. The number of passengers entering and leaving the United States through the port of Key West during the year of 1919 was only exceeded by the ports of New York and San Francisco. Key West is an extremely important military and naval base, and a submarine base is now in course of preparation, for which an expenditure of \$2,500,000 has been authorized; there is a large naval station at this port and it is the headquarters of the seventh naval district. The present system of aids to navigation is inadequate; it does not sufficiently meet the existing requirements of the larger vessels due to increased commerce as well as those gradually taking the place of the smaller vessels formerly entering this port. At the present time there is a minimum depth of 17½ feet at mean low water through Northwest Passage, yet the average master would rather take the longer and more dangerous route around Dry Tortugas than attempt to save 65 miles by taking his vessel through Northwest Passage when bound from the Straits of Florida into the Gulf of Mexico en route to a Gulf port. It is now proposed to establish a complete system of range lights on permanent structures which will not be destroyed nor displaced by the disastrous hurricanes that frequently strike this port, but will be in their proper position to enable vessels to enter the harbor at all times and under all conditions. Detailed estimate:

Florida Reefs: Iron towers for day beacons, 17, at \$5,000 each.....	\$85,000
Key West Harbor:	
Iron towers for lights, 11, at \$4,840 each.....	53,250
Illuminating apparatus, 6 acetylene, at \$1,500; 5 oil lanterns, at \$150.....	9,750
Spare accumulators.....	2,000
Total.....	150,000

No. 25. *Goat Island, Calif., Lighthouse Depot.*—Extending wharf and making other improvements at the Goat Island Lighthouse Depot, Calif., \$80,700.

NOTE.—The present wharf at the Goat Island Depot is inadequate for handling the business of the district. This is the only depot in the district, and all supplies and buoyage for the whole district are handled over the wharf. The wharf was built many years ago when the business of the district was about one-half of what it is at present, and when there was only one tender and one light vessel in the district. There are now two tenders and three light vessels in the district and one-half of the small wharf is constantly occupied by one of the light vessels, while relieved for overhauling and repairs. This leaves barely room for one tender to make fast, and practically no working room on account of the heavy buoys which it is necessary to keep near the face of the wharf. The work of the district is being conducted at a heavy loss due to delays in handling supplies and loss of time of tenders. Private business would not operate under such a handicap and the district should no longer continue to do so. It is proposed to extend the present wharf for a distance of 150 feet in a southerly direction, at a width of 50 feet, to construct a retaining wall in the rear of the new section, and to fill in an area of about 80 by 150 feet behind the wall, with the material from the adjacent bluffs. It is also proposed to drive two mooring dolphins at the north end of the present wharf to permit dropping the light vessel back from the face of the wharf and thus increase the working space. The present warehouse for depot supplies is a poorly constructed and overcrowded frame building over 40 years old. It is badly decayed in places and fast getting beyond repair. A plain, reinforced fireproof building, 40 by 100 feet and three stories high, is required to replace the present dilapidated two-story structure and furnish necessary storage space. Detailed estimate:

Reinforced concrete warehouse (40 by 100 feet), 139,000 cubic feet, at \$0.2875 per cubic foot.....	\$40,000
Sea wall, 255 linear feet, averaging 15 feet high and 3 feet thick, at \$18 per linear foot.....	4,590
Dock fill (approach), including plank covering, 85 by 140 feet, at \$0.48 per square foot.....	5,710
Dock proper (50 by 150 feet), 12 inches diameter, iron piling, 15 inches, I beams, and 4 by 14 inch deck joists and 4-inch deck planking, at \$3.65+ per square foot.....	27,375
Creosoted piles in dolphins, 1,900 linear feet, at \$1.52.....	3,025
Total.....	80,700

No. 26. *Sandusky Bay, Ohio, aids to navigation.*—Constructing a light and fog signal at the entrance to and improving existing aids to navigation Sandusky Bay, Ohio, \$126,000.

NOTE.—The act of June 17, 1910 (36 Stat., 536), authorized the establishment of a light and fog signal at the entrance to Sandusky Bay, Ohio, at a cost not to exceed \$80,000, but no appropriation for the project has been made. The need for more efficient aids to mark the entrance to this harbor has been long recognized by marine interests. The entrance is especially difficult to locate in thick weather, and an adequate fog signal is therefore essential. The east jetty is to be extended and a pierhead provided for the lighthouse foundation at its outer end by the U. S. Engineer Department. An appropriation for this work has been made and contract for the construction of the underwater portion of the pierhead has been awarded by the U. S. Engineers. This necessitates prompt action toward construction of the remainder of the pierhead and station superstructure by the Lighthouse Service. Quarters for at least two additional keepers will be required when the new station is completed. Space for same is available on site already owned by the Lighthouse Service in the immediate vicinity. It is also proposed to replace the present frame structures of the inner and outer ranges with steel towers and install an electrical system to operate these lights and the proposed light and fog signal at the end of the jetty. Sandusky is one of the important ports of Lake Erie, and its lake commerce is increasing. The receipts and shipments by water during the season of 1917 were 4,500,000 tons, valued at over \$20,500,000. There is also an extensive passenger traffic to adjacent islands. Detailed estimate:

Reinforced concrete base, 1,000 cubic yards, at \$25.....	\$25,000
Removing old structures and surfacing piers, 2 sites, at \$750, and 2 sites, at \$1,750	5,000
Steel tower metal work, 90 tons, at \$300 in place	27,000
Power house, 10,000 cubic feet, at 50 cents.....	5,000
Fog-signal and illuminating apparatus.....	22,200
Submarine cable, 16,900 feet, at \$1.59.....	26,800
Dwelling, 30,000 cubic feet, at 50 cents.....	15,000
Total.....	126,000

No. 27. *Oswego Harbor, N. Y., aids to navigation.*—Improving aids to navigation and removing old structures at Oswego Harbor, N. Y., \$16,000.

NOTE.—The present fog bell at this station is inadequate. Petitions for a more powerful fog signal have been received from marine interests. It is proposed to carry electric power to the station by means of a submarine cable and install a compressed-air fog signal. There is an old stone lighthouse tower, no longer used, located at the angle in the inner breakwater. The cribwork surrounding this tower is in the custody of the Lighthouse Service and is in a dilapidated and damaged state. The maintenance of this cribwork with lighthouse funds is no longer warranted, although it still forms part of the protection works of the harbor. The War Department has indicated it will take over the care and custody of the lighthouse pier upon removal of the stone structure referred to, and an item for that purpose is included in the estimate. Severe storms are causing additional damage to the cribwork, and it is uncertain as to how soon the foundation of the tower will be endangered. Detailed estimate:

Cable at \$1.60 per foot, 2,200 feet.....	\$3,520
Motor air compressor.....	2,000
Diaphone.....	1,350
Piping, valves, and installation	1,650
Electric installation.....	1,000
Razing tower and attached structure, 2,000 tons stone, at \$1.....	2,000
Disposing of material, at \$2.10 per ton, 2,000 tons.....	4,200
Total.....	16,000

No. 28. *Detroit River, Mich., patrol boat.*—The Secretary of Commerce is authorized to expend not to exceed \$25,000 of the unexpended balance of the appropriation of \$210,000, made for establishing aids to navigation along the Livingstone Channel, Detroit River, Mich., including authority to locate and construct lights and place buoys necessary to mark this channel (act approved Mar. 4, 1911; 36 Stat., 1431), for the construction, or purchase, and equipment of a suitable patrol boat for tending the aids to navigation in said channel and adjacent waters.

NOTE.—Under the act of March 4, 1911 (36 Stat., 1431), a system of lights and buoys has been established to aid navigation in the Livingstone Channel, Detroit River, Mich. These aids are now completed, and a balance of \$59,000 remains unexpended from the appropriation made for this purpose. These aids need a considerable amount of attention and to maintain them properly a special boat to be devoted almost exclusively to this work is necessary. Heretofore an old launch that has been in the Service 12 years has been used for tending these aids, but it is now practically unserviceable, and also it is not large enough for the requisite carrying and hoisting capacity. It is estimated that a suitably small tender can be obtained for \$25,000, and it is recommended that authority be granted to expend this amount from the appropriation made for establishing the aids, no additional appropriation by Congress being needed.

Total group No. 1, authorized by law, \$6,235,000; not authorized, \$1,640,250; total, \$7,875,250.

GROUP NO. 2.

Works considered essential for the needs of navigation and the equipment of the Lighthouse Service, and which it is recommended be undertaken as resources permit, are submitted with estimates of cost. (These items have been selected from a much larger number of recommendations submitted by the superintendents of the lighthouse districts and others.)

No. 29. *Additional buoys, fifth lighthouse district.*—Establishing additional buoys in Chesapeake Bay and York River, Va., for use of Atlantic Fleet, \$44,600.

NOTE.—There were established during the war a considerable number of additional buoys, including many gas buoys, for the use of the Atlantic Fleet in marking approaches to bases and drill grounds in the lower Chesapeake Bay and York River. It was possible to establish and maintain these buoys during the war emergency only by using buoys normally and properly held in reserve for relief purposes, the marking of wrecks, etc., and temporarily discontinuing certain gas buoys in other localities. The reestablishment and maintenance of these aids has been requested by the Navy Department. Detailed estimate:

10 type "L" gas and bell buoys, at \$3,481.70 each.....	\$34,817
1 main channel bell buoy.....	950
1 type "BW" 600-II gas and whistling buoy.....	5,013
Chain, sinkers, and shackles.....	3,820
Total.....	44,600

No. 30. *Point Pinos, Calif., light station.*—Improving Point Pinos light station, Calif., \$37,500.

NOTE.—The combined dwelling and tower at this station was built in 1855, and improvements are required at the present time to keep them in a serviceable condition. Fogs occur frequently at this point, and a first-class compressed air signal, together with quarters for two additional keepers are urgently required. The present assistant keeper at this station is obliged to use a coal shed for quarters. The port

is an important one, on account of the large number of tank steamers which ply there regularly, crude oil being delivered at this place by a pipe line from the fields in the interior of the State. Numerous requests have been received from shipmasters to establish a fog signal at this point, and the volume and value of the traffic in and out of the port fully justify the establishment of such a signal. Detailed estimate:

Fog-signal building.....	\$4,500
Fog-signal apparatus.....	11,500
Dwelling for two keepers.....	16,000
Improvements to present station.....	5,500
Total.....	37,500

No. 31. *Woods Hole, Mass., lighthouse depot.*—Dredging off a point to give entrance to Little Harbor, Woods Hole Depot, Mass, \$18,000.

NOTE.—The bar through which the channel was dredged in 1917 has again filled in, and it is believed that it is impracticable to maintain a channel through this bar owing to the excessive current. By cutting off the point referred to and following the natural course of the channel, it is believed that no difficulty from filling in will be experienced at this point in the future. Estimate of cost:

Dredging, 30,000 cubic yards, at \$0.60 per cubic yard.....	\$18,000
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No. 32. *Santa Barbara, Calif., light station.*—Improving Santa Barbara Light Station, Calif., \$33,000.

NOTE.—A combined dwelling and tower at this station was built in 1856 and is entirely too small to accommodate the modern revolving lens now installed in it. The tower stands one-eighth of a mile back from the shore line and the light is at present obscured by trees on adjacent properties. A new tower should be built farther out near the shore line and a first-class compressed-air fog signal installed. North-bound coasting vessels keep close in shore to avoid the prevailing northwesterly wind and sea and a fog signal at this point is urgently required. The nearest aid to navigation to the southward is Point Hueneume Light Station 30 miles distant while the nearest aid to the northward is the Point Conception Light Station nearly 40 miles distant. There is heavy traffic through the Santa Barbara Channel at all times and the distance of 70 miles between adjacent fog signals is too great for the proper protection of navigation. Detailed estimate:

Tower, lantern, and fog signal building.....	\$10,000
Fog-signal apparatus.....	11,500
Dwelling for additional keeper.....	8,400
Improvement to present station.....	3,100
Total.....	33,000

No. 33. *Portage Lake, Mich., aids to navigation.*—Establishing a light and fog-signal station upon a new site and improving aids to navigation at Portage Lake Ship Canals, Mich., \$100,000.

NOTE.—The War Department intends to remove the breakwater, and it is therefore necessary to rebuild the light and fog signal on a new site. The new light and fog signal should be established on a pier of the outer entrance, where it would be of the best service to vessels making the harbor. The construction of the station proposed will require considerable time to complete, and this project should have consideration for that reason. The harbor pier on which the present pierhead light station and fog-signal house stand, as well as the timber superstructure under the fog-signal house, are rapidly deteriorating, and it is doubtful if these structures can be maintained much longer in a safe condition unless extensive repairs are made to their foundations, which would be unnecessary in the event of the establishment of the proposed new station. Detailed estimate:

Foundation and concrete base of tower.....	\$61,000
Superstructure.....	22,500
Fog signal and lighting equipment.....	13,500
Total.....	100,000

No. 34. *Cape Kumukahi, Hawaii, Light.*—Establishing a light at or near Cape Kumukahi, Hawaii, \$26,500.

NOTE.—Cape Kumukahi is the easternmost cape of Hawaii. There is at present no landfall light for vessels bound to Hilo from the Panama Canal or from the southeast. It is a difficult point to round when sailing from Hilo to the south point or vice versa. A light on this point would be of great improvement to the lighting of the islands. An acetylene light is recommended, with a focal-plane height of about 145 feet above the sea, which would be visible about 20 miles. Landing from seaward at the cape is impossible at most times, and the only practical method of supplying this station would be by railroad from Hilo to Kapoho and then by wagon road 3 miles to the cape, 1½ miles of which would have to be constructed over the rock. Detailed estimates:

Station site and right of way for road.....	\$500
Concrete foundation for tower.....	1,210
Superstructure, iron-pipe tower.....	11,250
Illuminating apparatus.....	4,640
Roadway, construction of.....	8,900
Total.....	26,500

No. 35. *Grays Harbor, Wash., Light Station.*—Improving Grays Harbor Light Station, Wash., \$20,000.

NOTE.—The present steam fog-signal plant at this station is located in a frame building. Both the machinery and building are quite old and in poor condition. It is proposed to construct a new fireproof building and install a more modern fog signal as soon as funds permit. Detailed estimate:

Fog-signal building.....	\$9,690
Purchase and installation of apparatus.....	10,310
Total.....	20,000

No. 36. *Inland waterway, Norfolk, Va., to Beaufort Inlet, N. C., aids to navigation.*—Establishing and improving aids to navigation to mark the improved inland waterway from Norfolk, Va., to Pamlico Sound, N. C., \$89,000.

NOTE.—The work of the United States engineers on the 12-foot project for inland waterway from Norfolk, Va., to Beaufort Inlet, N. C., has reached a point where it seems certain that an available depth of 12 feet throughout will be available in the latter part of 1920. The section from Norfolk, Va., to Albemarle Sound, N. C., is completed to a 12-foot depth, and, pending the completion of the ultimate project via Alligator River and Pungo River, it is proposed to dredge a 12-foot channel through Croatan Sound, N. C., and across Bluff Shoal, N. C., in Pamlico Sound, N. C. Traffic through this waterway is now increasing, and recent reports indicate heavy traffic when the channel is completed. There will have been expended on this project at that time approximately \$3,400,000, and in order to make the same fully available to the anticipated through traffic it will be necessary to establish about 29 small acetylene lights, 25 unlighted beacons, 14 spar buoys, and 2 gas and bell buoys. These aids will at the same time replace 14 existing lights of an antiquated and inefficient type and which, having been in service about 30 years, are in need of renewal. To render the tending of certain aids of this project more effective and to provide a sheltered wharf for lighthouse tenders in passage to the North Carolina Sounds, the present depot and dwelling located at Long Point, N. C., should be moved to Coinjock, N. C. Long Point is low, isolated, and open to the sea, while Coinjock is on high ground along the canal banks. It has the additional advantage of telephone and telegraph communication and highway connections. Detailed estimate:

Pile foundations.....	\$6,885
Rear range towers.....	6,250
Illuminating apparatus.....	29,805
Unlighted beacons.....	3,750
Spar buoys with moorings.....	600
Gas and bell buoys with moorings.....	14,400
Fender dolphins.....	1,310
Purchase of sites.....	1,000
Wharf.....	18,000
Moving dwelling and storehouse.....	7,000
Total.....	89,000

No. 37. *Tumbler Island Light, Me.*—Establishing a light at or near the westerly end of Tumbler Island, entrance to Boothbay Harbor, Me., \$5,800.

NOTE.—The need of light on Tumbler Island has long been felt and expressed by mariners and others interested. A petition having the names of 196 persons was presented to the Lighthouse Service in 1916. Several vessels have been badly damaged by running on Tumbler Island and one life lost. This island is low and lies well out into the channel, with deep water close up to it on the westerly side. In approaching the harbor at night Tumbler Island appears to lap onto McKown Point, making the turning very difficult to locate. A light properly located would very much facilitate entering the harbor at night and greatly reduce the hazard. Up to 1917 there were from 50,000 to 60,000 tons of freight entering and leaving the harbor; since then the tonnage has been increased on account of several shipping yards established in the vicinity. The passenger traffic is also considerable. Detailed estimate:

Light structure, including site.....	\$3,350
Illuminating apparatus.....	2,050
Contingencies.....	400
Total.....	5,800

No. 38. *Staten Island, New York, Lighthouse Depot.*—Extending and enlarging machine shop at the General Lighthouse Depot, Tompkinsville, Staten Island, N. Y., \$30,000.

NOTE.—The present machine shop is so constructed as to be unadapted for the work which is done in it; and will have to be extended and enlarged before it can be made an efficient and economical shop. The act of July 19, 1919 (41 Stat., 213), appropriated \$30,000 for this work and the act of June 5, 1920 (Public—No. 275, 66th Congress), authorized \$15,000 additional, but no appropriation has been made therefor.

The work can not possibly be done for the \$30,000 appropriated and the advance in building costs since estimate was first submitted will necessitate the authorization of \$30,000 additional or a total of \$60,000 for this work. Detailed estimate:

Alterations to present shop.....	\$7,500
New addition.....	52,500
Total.....	60,000
Less appropriation made by act of July 19, 1919.....	30,000
Amount required.....	30,000

No. 39. *Spectacle Reef, Mich., Light Station.*—Improving Spectacle Reef Light Station, Mich., \$22,000.

NOTE.—The act of July 1, 1918 (40 Stat., 608), appropriated \$28,000 for improving Spectacle Reef Light Station, Mich. The work has not yet been actively commenced due chiefly to the lack of tender service available for the work and partly also to the high cost of labor and materials, making it doubtful whether the work, if started, could be completed within the funds appropriated. Costs have increased greatly, so that it is necessary to have an increase in the appropriation to carry out the work on the basis of present prices. The work consists in the repairing of the concrete pier 90 feet square surrounding the Spectacle Reef Lighthouse and protecting it from ice. This pier has been badly eroded at and below the water line, at some places having been cut into as much as 4 feet. Repairs are very expensive and difficult but they should be undertaken at a very early date. Detailed estimate:

Steel ice protection.....	\$6,500
Concrete work.....	30,000
Anchorage to old work.....	7,000
Transportation of materials, and contingent costs.....	6,500
Total.....	50,000
Less appropriation made by act of July 1, 1918.....	28,000
Amount required.....	22,000

No. 40. *Red Rock, Calif., Light and Fog Signal.*—Establishing a light and fog signal on Red Rock in the northern part of San Francisco Bay, Calif., \$14,500.

NOTE.—Red Rock is a bold, rocky island in the northern part of San Francisco Bay, rising to a height of 159 feet, with deep water close to its shores. It lies in the path of the very heavy up-bay and up-river traffic, as well as in the path of all craft proceeding to and from the Mare Island Navy Yard, and is also directly in the path of the passenger and automobile ferry steamers plying between Castro Point and Point San Quentin. Requests have been received from the masters of river steamers, of oil tankers, and from the Richmond & San Rafael Ferry & Transportation Co. to suitably mark this island with a fog signal and light. The commander in chief of the Pacific Fleet has requested that the shoal lying to the southward of the island be marked by a gas buoy and a light and fog signal on the rock will take the place of such a buoy. It is proposed to establish a compressed air diaphone on the south end of the island, to be electrically operated by power supplied by one of the local power companies through a cable 1 mile long from Castro Point to the island, and to establish a sixth-order flashing electric light of about 3,200 candlepower, the light and fog signal to be controlled by electric switches by the watchman man at the Castro Point ferry slip. Detailed estimate:

Establishing 300 mm. lens for electric light.....	\$600
Electric fog-signal apparatus, including small building.....	13,900
Total.....	14,500

No. 41. *Port Real, P. R. (or East Point Vieques Island), Light Station.*—Establishing a light station at or near Port Real, P. R., or East Point Vieques Island, \$40,000.

NOTE.—The lighthouse at Port Ferro, on the south coast of Vieques, or Crab Island, is one of the primary seacoast lights of the Porto Rican system. The light tower and the keepers' dwelling attached to it are built on top of a rocky promontory undermined for some time by the sea, and the whole structure, already dangerously cracked, is in danger of collapsing. It is urgent to rebuild a lighthouse at or near this point, as this is an important aid to the navigation from St. Thomas to Cuba and other West Indian Islands and the Caribbean Sea. A light in this vicinity is necessary for navigation, and it is proposed to dismantle the present Port Ferro Light Station and to erect a new light station at Port Real, about 3 miles westward, where the aid will be more useful and on better ground than on its present location at Port Ferro, as Port Real is the most important and the best anchorage around Vieques Island. The present apparatus at Port Ferro is to be used for this new station. Detailed estimate:

Tower.....	\$15,000
Dwelling for 2 keepers.....	10,000
Metal work.....	8,000
Woodwork.....	2,000
Outbuildings and fence.....	1,000
Purchase of site.....	2,000
Grading and walks.....	1,000
Installation of illuminating apparatus.....	1,000
Total.....	40,000

No. 42. *Nine Mile Point, Mich., Light Station.*—Establishing a light and fog-signal station at or near Nine Mile Point, Mich., \$50,000.

NOTE.—When Forty Mile Point Light Station was established it was placed on the site designated Forty Mile Point on the county-survey charts. Sailing masters expected the station to be placed at Nine Mile Point, near the entrance to the Straits of Mackinac, but which was not so called officially then. While Nine Mile Point is within the visibility of Spectacle Reef and Poe Reef Light Vessel lights, a fog signal would be of especially great service in thick and foggy weather and during seasons when forest fires prevail. No less than nine strandings occurred here between 1903 and 1909. In the event of establishing this station, Forty Mile Point could be made a minor light. Detailed estimate:

Tower and fog-signal building, including site.....	\$26,100
Illuminating apparatus.....	5,500
Fog-signal apparatus.....	2,000
Dwellings for 3 keepers.....	12,000
Outbuildings, boathouse, fences, etc.....	2,600
Boats and equipment.....	1,800
Total.....	50,000

No. 43. *Sag Harbor, N. Y., aids to navigation.*—Establishing acetylene lights in the channel leading into and in the vicinity of Sag Harbor, N. Y., and improving Sag Harbor Breakwater Light, and other aids to navigation in that vicinity, \$58,500.

NOTE.—The channel is crooked, narrow and rocky, and a system of lights to mark turns in channel and so located that vessels can run from light to light is badly needed. The Sag Harbor Light, which marks the entrance of the harbor, is used at long range and is not of sufficient power of light for the purpose. The new lights will be flashing acetylene lights with steel towers, so called, on concrete and riprap foundations. Detailed estimate:

Five acetylene lights complete.....	\$40,500
Improving present Sag Harbor Breakwater Light.....	7,100
Improving Cedar Island Light.....	11,000
Total.....	58,500

No. 44. *Great Salt Pond, R. I., Light Station.*—Completing light and fog signal on extreme end of breakwater, Great Salt Pond, R. I., \$53,000.

NOTE.—An appropriation of \$20,000 for this work was made by the act of June 12, 1917 (40 Stat., 161), but on account of increase in cost of labor and material and of changing the location to extreme end of breakwater, with foundation in much deeper water than was previously planned, and in order to make this harbor available for submarines, the funds previously appropriated are insufficient and an additional appropriation is required to complete the work, the original appropriation being only sufficient to construct the foundation in the extra depth of water. Detailed estimate:

Tower, dwellings, and engine room on concrete foundation.....	\$36,000
Fog-signal apparatus.....	8,500
Illuminating apparatus.....	2,100
Installation of fog-signal machinery and illuminating apparatus.....	3,100
Oil-storage tanks.....	1,300
Incidentals.....	2,000
Total.....	53,000

No. 45. *Fairport Harbor, Ohio, aids to navigation.*—Improving the aids to navigation at Fairport Harbor, Ohio, additional to amount appropriated by act of June 12, 1917, \$44,000.

NOTE.—The act of June 12, 1917 (40 Stat., 161), appropriated \$42,000 for improving aids to navigation at Fairport Harbor, Ohio. This estimate contemplated the construction of a new lighthouse on the west breakwater pierhead and installation of a compressed-air fog signal. Owing to the increased cost of all materials and labor the appropriation is insufficient to carry out the project. Upon completion of the new structure an additional keeper will be required, making three in all. Quarters are now provided for only one keeper. An item has, therefore, been included in this estimate to cover remodeling the old dwelling and building a new double dwelling, providing quarters for the three keepers. Detailed estimate:

Remodeling old dwelling, 1 keeper.....	\$3,500
New double dwelling, 2 keepers.....	16,500
Concrete foundation.....	10,000
Superstructure.....	42,500
Illuminating and fog-signal apparatus.....	10,050
Boathouse, boats and accessories.....	3,000
	86,000
Less amount appropriated by act of June 12, 1917.....	42,000
Total.....	44,000

No. 46. *Two Rivers, Wis., pierhead.*—Improving light and fog signal at Two Rivers, Wis., \$7,400.

NOTE.—This station is now equipped with an electrically operated fog bell and sixth-order lens illuminated by wick-oil light. For several years past there has been an insistent demand from Two Rivers that the fog signal be improved, owing to the fact that craft operating out of Two Rivers found the bell of little assistance in making the port during fog. As it is necessary to maintain two keepers to operate the bell, the operating expense will be increased but little if an adequate and efficient signal is installed. It is proposed to install a diaphone fog signal and electrically driven compressors (current from city) and provide an oil-engine-driven electric generator for emergency use. Also to install electric light in sixth-order lens in place of oil light. Detailed estimate:

Repairs to present wooden tower and to frame power house.....	\$700
Fog-signal equipment.....	6,600
Illuminating equipment.....	100
Total.....	7,400

No. 47. *Otter Island, Me., light.*—Establishing a light on Otter Island, Muscle Ridge Channel, Me., \$3,600.

NOTE.—A light at this point has several times been petitioned for.

Muscle Ridge Channel is much frequented by vessels of all classes except those of deep draft, especially by steamers carrying large numbers of passengers. The channel is about 9 miles long from Whitehead Light Station on the south to Owls Head Light Station on the north, and it is bordered on both sides with dangerous ledges and submerged rocks, making it difficult to navigate, especially at night and in thick weather. On account of the large number of people resorting to the State of Maine during summer, passenger traffic through the channel is very heavy. Several vessels have been wrecked in Muscle Ridge Channel in recent years, among them the steamer *City of Rockland*, loaded with freight and passengers, which in the summer of 1904 struck on the upper gangway, in the vicinity of Otter Island, and after floating off sank near Grindstone Ledge. It is proposed to establish an acetylene light on the iron tripod which

now serves as a daymark only. Commercial statistics for 1919 indicate that 128,749 tons of freight entered Rockland, with the probability that a large portion of it passed through Muscle Ridge Channel. Records furnished by the United States Life-Saving Station at Whitehead show that during the 15 years preceding 1903 there were more than 70 accidents in this channel and vicinity, quite a number of them resulting in total loss of vessel. Detailed estimate:

Modification of present structure	\$1,100
Illuminating apparatus	2,150
Contingencies	350
Total	3,600

No. 48. *Riprap protection for light stations, second lighthouse district.*—Providing riprap to protect foundations of light stations from damage by sea and ice in the second lighthouse district, \$19,700.

NOTE.—Practically all these stations are on submarine sites and are subject to damage from sea and ice. Riprap is needed for the first light mentioned to provide a foundation for an acetylene light. The foundations of the other stations have been considerably damaged and weakened by ice during past winters and should now be protected by riprap to prevent danger of their being more seriously damaged in the future. Detailed estimate:

Saltwater Breakwater, Mass.	\$3,600
Narrows Light, Mass.	3,000
Gallups Island, Mass.	2,000
Brant Point, Mass.	3,600
Bird Island, Mass.	4,500
Duxbury Pier, Mass.	3,000
Total	19,700

No. 49. *Cape Cod, Mass., light station.*—Improving fog signal at Cape Cod Light Station, Mass., \$6,000.

NOTE.—Owing to the elevated location of the fog signal and to its distance from the shore, the present signal has been found inadequate in volume to be readily heard by mariners above the sound produced by the heavy surf on the beach at the station. As this is one of the most important fog signals in this district it is believed that the establishment of a more powerful signal will meet the needs of the mariner. A petition for this change was received from the maritime interests in December, 1919. Detailed estimate:

Fog-signal apparatus, including installation	\$6,000
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No. 50. *Charlotte, N. Y., light station.*—Improving Charlotte Light Station, N. Y., \$49,500.

NOTE.—This station consists of a low frame tower with fog-signal house addition on outer end of west pier, Charlotte Harbor. The fog-signal house is a frame structure covered with corrugated iron, the floor is concrete, with timber sill's resting on concrete piers. The sills are decaying and extensive repairs are urgently necessary. It is proposed to provide a more suitable and permanent structure of steel construction for this station, with a higher tower. This will increase the efficiency of the light, as there are numerous lights on shore forming the background. It is also proposed to bring electric power to the station from shore and install an electric air compressor with an improved fog-signal instrument, one of the present oil-engine compressors to be retained for emergencies. Detailed estimate:

Removal of old structure and maintenance of light and signal	\$1,600
Concrete base	4,800
Superstructure	35,000
Fog-signal apparatus and transmission line	6,500
Installation light and fog-signal apparatus	1,540
Total	49,500

No. 51. *Escanaba, Mich., Light Station.*—Improving light and fog signal and constructing and improving dwellings, Escanaba, Mich., \$71,000.

NOTE.—The port of Escanaba (and Gladstone) is one of the most important on Lake Michigan, shipping about 7,000,000 tons of iron ore each season and having coal, grain, and package freight commerce of importance.

The light was located on its present site at inner end of Sand Point in 1868. The sand point projects out into the bay about 1,400 feet from the light, being just awash out to the very end, beyond which it drops off to a depth of about 40 feet. This point is now marked at outer end by Sand Point Spar Buoy No. 3. The fog bell, operated by hand power machine, is located 1,400 feet from the outer end of the point. A bell is a very inadequate aid at best and in its present position must be considered as of very little value to the important commerce carried in boats of largest size.

It is proposed to construct a pile foundation with concrete superstructure, located near the outer angle of the point and erect an enclosed steel plate tower, run an electric transmission cable or air line from shore, move the present lens out to this tower and illuminate with electricity; install electric driven air compressors and first-class air diaphone siren in tower, operated by remote control from shore; electric power to be obtained from the city company and an oil engine driven generator to be installed on shore, in a small power house for emergency use. The present 1½-story dwelling to be improved and a new dwelling built for the assistant keeper. Detailed estimate:

Pile and concrete foundation	\$21,200
Steel tower and cast-iron lantern	12,720
Brick and tile power house on shore	5,600
Fog-signal equipment	16,300
Old 4th-order lens to be reinstalled	100
Repair and improve old dwelling	4,000
Erect new dwelling	10,080
Grading, walks, etc.	1,000
Total	71,000

No. 52. *Michigan Island, Wis., Light Station.*—Establishing and improving aids to navigation at or near Michigan Island, Lake Superior, Wis., \$85,000.

NOTE.—The act approved May 27, 1908 (35 Stat., 332), appropriated \$2,000 to make a survey and estimate of cost and report upon the feasibility and need of establishing a light and fog signal upon Gull Island or the easterly end of Michigan Island, Apostle Group. As a result of this survey, the conclusion has been reached that the eastern end of Michigan Island is the better site. The act of June 17, 1910 (36 Stat., 536), authorized the construction of a light and fog-signal station at Michigan and Gull Islands at a cost not to exceed \$140,000, but no appropriation has been made therefor. A further study indicates that the best plan is to elevate the present light near the westerly end of Michigan Island, add a fog signal, and establish a nonattended acetylene light on Gull Island. This arrangement would serve as a better guide to vessels passing in either direction. The project now contemplated will not cost as much as the amount authorized. Detailed estimate:

Foundation, main light.....	\$3,000
Dwellings for three keepers.....	20,000
Tower complete (erection only).....	6,000
Minor light.....	9,495
Illuminating apparatus.....	10,000
Fog signal and hoisting apparatus.....	13,550
Fog-signal building, boathouse, and other buildings.....	13,455
Boats, tramway, walks, etc.....	9,500
Total.....	85,000

No. 53. *Kauhola Point, Hawaii, Light Station.*—Improving the light station at Kauhola Point, Hawaii, \$28,500.

NOTE.—A 4th-order flash lens with i. o. v. apparatus is now installed on a temporary frame tower at this station. This is an important landfall station and it is recommended that the light be raised to a focal plane height of 110 feet. To support this lantern and lens and complete the improvements at the station, a 72-foot reinforced concrete tower with spiral cast-iron stairway and standard 4th-order round lantern is recommended. A dwelling for the assistant keeper should be provided; a small frame dwelling with asbestos shingle roof being proposed. Detailed estimate:

Reinforced concrete tower.....	\$22,975
Keeper's dwelling.....	5,000
Improvements to grounds.....	525
Total.....	28,500

No. 54. *Ram Island, Me., Light.*—Establishing a light on Ram Island, lower Kennebec River, \$6,000.

NOTE.—The need of this light has several times been expressed by petition. Ram Island is about 5½ miles below Bath, Me.; it is a low island in the middle of the river, with a string of half-tide ledges making off on the easterly side. There is a passage on either side, and at some stages of the tide a 5-knot current exists, from which several accidents have occurred. According to 1919 statistics about 126,000 tons of freight passed this island in that year, and in addition many pleasure craft and small boats frequent the river. It is proposed to establish an acetylene light on or near the easterly side of Ram Island. Detailed estimate:

Light structure, including site.....	\$3,350
Illuminating apparatus and installation.....	2,150
Contingencies.....	500
Total.....	6,000

No. 55. *Henderson Point, Me., Light Station.*—Establishing a light and fog signal at or near Henderson Point, Piscataqua River, Portsmouth Harbor, Me., \$8,400.

NOTE.—The need of this aid has several times been expressed by petition. It is often very difficult to locate Henderson Point at night and in thick weather; the channel is narrow and there is a strong tide at this point, where the course changes. The commercial statistics for Portsmouth Harbor indicate about 55,000 tons of freight passed this point in 1919. It is proposed to establish an acetylene light with fog bell. Detailed estimate:

Structure, including site.....	\$3,700
Illuminating and fog-signal apparatus.....	4,200
Contingencies.....	500
Total.....	8,400

No. 56. *Lake Champlain, N. Y. and Vt.*—Establishing acetylene lights, building and equipping a gasoline tender, and rebuilding Juniper Island Light Station wharf to accommodate the tender on Lake Champlain, and other improvements to aids to navigation on Lake Champlain, \$150,000.

NOTE.—In the interest of efficiency and economy it is proposed to discontinue all oil lights on Lake Champlain except at stations where there is a fog bell, and establish acetylene lights in their places. The motor-driven tender will remain constantly on the lake to care for the operation and repair of the light stations. This change from oil to acetylene will result in considerable saving. It will permit better care and maintenance of the aids to navigation on Lake Champlain and relieve the tender *Daisy* from this work, thus enabling her to do more work in the vicinity of New York Bay, where her services are much needed. Detailed estimate:

8 large lights.....	\$25,000
21 small lights.....	55,000
Gasoline tender.....	25,000
Rebuilding wharf at Juniper Island Light Station, with storeroom, gas-tank house, and ways for taking tender out of water in winter.....	45,000
Total.....	150,000

No. 57. *West Neebish Channel, St. Marys River, Mich., aids to navigation.*—Establishing and improving aids to navigation West Neebish Channel, St. Marys River, Mich., \$65,000.

NOTE.—There has long been a demand from vessel interests for range lights in the West Neebish Channel to mark the axis of the upper reaches of this channel. Steps have not heretofore been taken to establish these ranges, as it was hoped that the system of permanent side lights established when the channel was first opened would prove sufficient if well maintained. During the past three or four years, however, the ice action in the spring has been so severe as to destroy a number of the permanent structures making their reconstruction or replacement with floating gas buoys necessary. There are now five of these permanent structures replaced by buoys and two more have been completely rebuilt. Repairs to remaining permanent structures will be made under the act of November 4, 1918 (40 Stat. 1036) appropriating funds for this work. The result of replacing so many fixed pier lights with gas buoys has been that there is a considerable period both at the opening and close of the navigation season, when ice is running, when the buoys have to be removed, leaving the channel very poorly marked. Range lights would make safe navigation possible under these conditions as they could be maintained in commission and their construction and maintenance would cost less than to rebuild all pier lights now replaced by buoys. This channel is used by all down-bound vessels from the Lake Superior district and navigation through it should be made as safe as it is possible to make it. It is proposed to establish a range marking the axis of the upper reach in Hay Lake, the two structures to be located on piers in 6 feet of water, also a range marking the long reach following this and leading to the rock cut, both the latter structures to be located on shore. A light should also be established on the small island abreast of Moon Island Light No. 6, and Light No. 5 could be then discontinued. The old stone riprap submerged mounds at Lights No. 1 and No. 2 should be dredged away. Detailed estimate:

Foundations, upper reach range lights.....	\$33,000
Steel superstructure, upper reach range lights.....	3,000
Lighting equipment, upper reach range lights.....	3,200
Foundations, lower reach range lights.....	1,000
Steel superstructure, lower reach range lights.....	3,000
Lighting equipment, lower reach range lights.....	3,200
New light structure abreast of Moon Island.....	2,000
Lighting equipment for above.....	1,600
Removal of stone riprap mounds at old structures by dredging.....	15,000
Total.....	65,000

No. 58. *Sturgeon Bay, Wis., aids to navigation.*—Establishing aids to navigation and improving existing aids at or near Sturgeon Bay, Wis., \$49,000.

NOTE.—The aids now in use for the channel through Sturgeon Bay, especially north (or west) of the bridge are inadequate, obsolete as to position and in an advanced state of decay. It is proposed to discontinue the two Dunlap Reef Lights, as they are practically of no use at the present time; also discontinue the Hills Point Daymark; and discontinue Hills Point Gas Buoy No. 3 and Sturgeon Bay Entrance Gas Buoy No. 1.

It is proposed to establish one new acetylene light on Hills Point, near site of present daymark, and three new acetylene lights on cribs: one located at northerly end of Dunlap Reef, one on the east side of the channel, about 2,800 feet southeasterly of Hills Point, near site now occupied by Hills Point Spar Buoy No. 5, and one located on the east side of the channel about 4,500 feet northerly from Hills Point, near site now occupied by Sturgeon Bay Entrance Gas Buoy No. 1. Detailed estimate:

Light on Hills Point:	
Concrete foundation.....	\$1,380
Skeleton steel tower.....	1,200
Acetylene illuminating apparatus.....	1,500
	\$4,080
Lights on cribs:	
Cribs complete with concrete superstructures.....	30,000
Skeleton steel towers.....	3,600
Acetylene illuminating apparatus.....	4,500
	38,100
	42,180
Concrete superstructure for Sturgeon Bay Canal No. 4 light.....	1,800
Contingencies.....	5,020
Total.....	49,000

No. 59. *Thirteenth lighthouse district, storehouse.*—Constructing a storehouse for the thirteenth lighthouse district at Keokuk, Iowa, \$2,500.

NOTE.—The thirteenth lighthouse district, which embraces the upper Mississippi River and tributaries, has no facilities for storing supplies or other property, and the need for a storehouse has been increasing yearly. At present lighthouse supplies are being stored in the U. S. Engineer Department storehouse, which is needed for storage of supplies belonging to that department. Detailed estimate:

Frame storehouse.....	\$2,500
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Total group No. 2 (not included in estimates), \$1,237,500.

DESCRIPTIONS OF NEW WORKS COMPLETED.

WOODS HOLE DEPOT, MASS.

Purpose.—Woods Hole Depot wharf was rebuilt, the old wharf having become too rotten and worn to be serviceable.

Site.—The wharf is located on the west side of Woods Hole Little Harbor, Mass.

Structure.—The wharf is 400 feet long by about 30 feet wide. It is built of oak piles driven 12 feet into the bottom with the bark left on, and is decked with prime long-leaf yellow pine. The girders are of the open clamp type, each made of two 4 by 12 inch pieces, bolted on opposite sides of 4-inch pile tenons by two seven-eighths-inch galvanized-iron machine bolts to each tenon. The piles are spaced 6 feet in the girders and 8 feet in bents. The girders are 4 by 12 inches, spaced 2 feet on centers. The cap log is 8 by 10 inches and the chocks 6 by 8 inches. The deck is of 3 by 10 inch planks, laid one-half inch open and secured in place by 8-inch galvanized-wire spikes. The tenons of all piles, the girder pieces, and stringers were all thoroughly creosoted.

Cost.—The wharf was commenced in July, 1919, and was completed on January 8, 1920. It was carried on under contract at a cost of \$12,998, and paid from general expenses, Lighthouse Service, 1920.

STATEN ISLAND LIGHTHOUSE DEPOT, N. Y.

Purpose.—For improving the offices and laboratory at the General Lighthouse Depot by bringing them all under one roof, thereby concentrating the work of the office force and increasing its efficiency. The offices and laboratory were formerly located in four separate buildings.

Site.—The building is located on the grounds of the General Lighthouse Depot at Tompkinsville, Staten Island, N. Y.

Structure.—It is a three-story brick building on a concrete foundation and with a mansard roof of slate and tin. The floors and roof are supported by a structural steel framework which is protected and strengthened by reinforced concrete. The wooden floors are laid on sleepers embedded in the concrete. The trimmings are of granite. The new portion of the office consists of a western wall, two angle walls, and the roof, combining the three old office buildings in one structure. It is provided with modern conveniences, viz, steam heat, electric lighting, toilets, washrooms, etc.

Cost.—The work was carried out by several contracts under the appropriation of \$21,000, made by the act of June 12, 1917. The amount expended to June 30, 1920, was \$19,663.65. The work was started in November, 1918, and completed in March, 1920.

AMBROSE CHANNEL LIGHTED BUOYS, NEW YORK.

Purpose.—To substitute type "L" buoy for type "C" mantle buoys, thus improving the lighting system of Ambrose Channel, New York.

Site.—Five new buoys were established to mark the Ambrose Channel, New York Lower Bay, at the entrance to New York Harbor.

Illuminating apparatus.—The illuminating apparatus of these buoys consists of 200 mm A. G. A. lanterns. The characteristic is fixed white, and the illuminant used is acetylene gas.

Cost.—The order for the buoys was placed in June, 1919, and the buoys placed on station in April, 1920. Amount expended to June 30, 1920, was \$25,743.80.

AIDS TO NAVIGATION, DELAWARE RIVER, PA. AND DEL.

Purpose.—Chester Range Lights, Pa., and Marcus Hook Range Lights, Del., were established for the reason that the new 35-foot channel made it necessary to abandon the Schooner Ledge Range line and to substitute therefor two range lines designated as above.

Chester Range Lights were established April 10, 1918.

Marcus Hook Range Front Light was established May 11, 1918.

Marcus Hook Range Rear Light was established December 27, 1919.

Sites.—Chester Range Front. Located in the Delaware River, Pa., on a submarine site in 13 feet of water at mean low water, on the northwesterly side of main channel.

Chester Range Rear. Located on a land site 100 feet square consisting of mud. Finished grade is 12 feet above mean low water on the northwesterly side of the Delaware River, Pa., and northeasterly side of Crum Creek, Pa.

Marcus Hook Range Front. Located in the Delaware River, Del., on a submarine site in 2 feet of water at mean low water, on the northwesterly side of the main channel.

Marcus Hook Range Rear. Located on a land site in Gordon Heights, Del., 100 by 150 feet, consisting of clay and granite. It is 183 feet above mean low water.

Structures.—Chester Range Front. Comprises a timber crib 15 by 16 feet, filled with concrete, in 13 feet of water at mean low water, the top extending 6 feet above mean high water and supporting a 50-foot skeleton steel tower surmounted by a 350-millimeter A. G. A. range lens lantern. The foundation is protected by riprap.

Chester Range Rear. Comprises four reinforced concrete piers resting on a pile and grillage foundation 9 feet below grade line, supporting a 100-foot skeleton steel tower surmounted by a locomotive headlight lantern.

Marcus Hook Range Front. Comprises a hollow concrete block 20 feet square resting on a pile foundation, in 2 feet of water at mean low water, and extending 6 feet above mean high water; supports a 72-foot skeleton steel tower surmounted by a 350-millimeter A. G. A. range lens lantern.

Marcus Hook Range Rear. Comprises a square reinforced concrete tower resting on a reinforced concrete base extending 11 feet below the grade line. Each corner is reinforced with a battered concrete counterfort extending to the underside of the balcony deck. The tower is surmounted by a square reinforced concrete lantern, with balcony of same materials. The focal plane is 96 feet above grade line. The stair space inside is 10 feet 8 inches square and is provided with eight reinforced concrete landings and eight flights of stairs consisting of 8-inch channel stringers and 8-inch channel treads filled with concrete. Pipe handrailings are provided. The eighth landing is provided with a reinforced concrete partition forming a watch room, in which is placed an iron ladder extending to the lantern.

Illuminating apparatus.—Chester Range Front. The illuminating apparatus comprises a 350-millimeter range lens lantern, from which is shown a flashing white automatic acetylene gas light; intensity, 6,000 candles. The focal plane is 58 feet above mean high water.

Chester Range Rear. The illuminating apparatus comprises a 6th-order range lens in a locomotive headlight lantern, from which is shown a fixed white acetylene gas light; intensity, 20,000 candles. The focal plane is 112 feet above mean high water.

Marcus Hook Range Front. The illuminating apparatus comprises a 350-millimeter range lens lantern, from which is shown a flashing white automatic acetylene gas light; intensity, 6,000 candles. The focal plane is 81 feet above mean high water.

Marcus Hook Range Rear. The illuminating apparatus comprises a 4th-order range lens mounted on an iron pedestal provided with a 35-millimeter incandescent oil-vapor outfit, from which is shown a fixed white light; intensity, 10,000 candles. The focal plane is 278 feet above mean high water.

Quarters.—Chester Range Front and Rear Stations and Marcus Hook Range Front Station are unattended lights and no quarters are provided.

Marcus Hook Range Rear. Quarters are provided for one keeper and consist of a two-story brick dwelling with asbestos shingle roof resting on concrete walls inclosing cellar, with hot-water heating plant installed therein. The first floor consists of an inclosed veranda, hall, kitchen, dining room, and living room. The second floor has three bedrooms, hall, and bathroom. A brick garage, with oil house built therein, is provided and connected with the dwelling, tower, etc., by concrete walks. Supplies are hauled to this station direct from Edgemoor Lighthouse Depot, which is located on the northwesterly shore of the Delaware River, Del., a distance of approximately 3 miles.

Fort Mifflin Fog Signal (improvement).—In connection with the lights herein described, it was found desirable to discontinue the ineffective bell fog signal on the parapet at Fort Mifflin, Pa., and to substitute therefor an improved electric siren on the end of the pier which had just been completed by the United States Army engineers at Fort Mifflin and which extended out close to the main channel. The funds under the above-named appropriation being sufficient for this purpose and available therefor, the improvement was made under this special appropriation.

Structure.—The structure comprises a steel lattice column on outer end of lower pier, supporting an electric siren 23 feet above mean high water.

Cost.—The aids described above were established and improved under the act of July 1, 1916, appropriating \$80,000. The total cost was \$79,937.80. Work was carried

on under four contracts, the structural steel towers and other material being purchased on a separate contract and delivered to the contractor for erection. Some work not included in contracts was done by hired labor. Work was commenced on March 12, 1917, and completed on December 27, 1919.

TANGIER SOUND LIGHT STATION, CHESAPEAKE BAY, VA.

Purpose.—Tangier Sound Light Station, a screw pile lighthouse on five wrought-iron piles, was badly twisted and racked by ice during the winter of 1917-18, making it necessary to renew or rebuild the foundation under the structure.

Site.—The station is located on the west side of the south entrance of Tangier Sound and marks a dangerous shoal. The structure is on a submarine site, the depth of water being 4 feet at mean low water, and the rise and fall of tide 2 feet 6 inches. The bottom is hard sand, but when subject to strong currents easily scours.

Structure.—Repairs to the structure consisted of building a mass concrete foundation in the form of a hollow square founded on and encasing timber piles. The wrought-iron piles of the lighthouse were likewise encased in the concrete foundation. The central portion of the foundation was filled with sand and covered with small riprap stone. Considerable difficulty was encountered by the contractor in the preliminary operations of driving and maintaining the sheet piles and wales which made the forms for the concrete foundation on account of storms and erosion incident thereto. The bottom was finally sealed with concrete placed under water and the forms pumped out and the remainder of the concrete for the foundation was deposited in the dry. Riprap stone was deposited around the station simultaneously with the construction of the foundation and together with the use of sand bags placed as the sheet piles were driven, prevented further erosion and enabled the work to proceed.

Cost.—The foundation and placing of riprap stone was carried out under two separate contracts, both under the act of November 16, 1918. The work was commenced in April, 1919, and completed in October, 1919, at a total cost of \$32,573.

OLD PLANTATION FLATS LIGHT STATION, CHESAPEAKE BAY, VA.

Purpose.—Old Plantation Flats Light Station, a screw pile lighthouse on five wrought-iron piles, was badly damaged by ice during the winter of 1917-18, two of the foundation piles were broken and the rest badly twisted, but the dwelling remained intact on the three unbroken piles. It was decided to strengthen these piles, and protect the structure from future attacks of ice by building a mound of carefully placed riprap under and about it.

Site.—The station is located on a shoal near Cape Charles City, Va., and is an important aid guiding to the harbor. The structure is on a submarine site, the depth of water being 11 feet at mean low water and the rise and fall of tide 3 feet.

Structure.—The work consisted in depositing riprap stone compactly placed under and about the structure in pyramidal form in sufficient quantities to secure the old broken piles, and support the bent piles completely, and also to offer sufficient resistance to the impact of fields of ice for the purpose of breaking them up and thus aid in securing the safety of the station. In the process of depositing this stone, bays were left for the landing and departure of station boats. Four thousand six hundred tons of stone were deposited.

Cost.—The riprap was placed under one contract costing \$37,140.30, under the act of November 16, 1918. The work was commenced in September, 1919, and completed in January, 1920.

IMPROVEMENTS AND REPAIRS, LIGHTHOUSE TENDER "COLUMBINE."

Purpose.—This tender was originally designed for the lighthouse engineer's branch of the Lighthouse Service, and not being equipped nor properly arranged for work with modern aids to navigation, an extensive rearrangement of quarters was accomplished. Quarters for superintendent and radio operator were constructed on the upper deck and officers quarters rearranged on the main deck. This vessel just previous to overhauling had been engaged on the heavy work of placing and removing submarine nets under the fifth naval district involving excessive wear and tear on the vessel. As a result, a reconditioning of the ship was required. The vessel was docked and given a general overhauling. New buoy port pads, new bilge keels of the bar type, keel shoe, stem shoe, hawse pipe, windlass, parts of main deck, bollards, main rails, bulwarks, derrick irons, berths, lockers, etc., were installed. There were

furnished and fitted new skylights, boat davits, ventilators, closets, etc. The upper deck was recanvassed as well as the top of master's quarters and pilot house and much of the mechanical equipment renewed, including repairs and improvements to main engines and auxiliaries.

Cost.—The work was done from general expenses, Lighthouse Service, 1920, at a cost of \$54,556. It was started November 26, 1919, and completed May 5, 1920.

IMPROVEMENTS AND REPAIRS, LIGHTHOUSE TENDER "MAPLE."

Purpose.—The inadequate accommodations for ship's officers on board the tender *Maple* and the necessity for providing quarters for a wireless operator and space for radio apparatus made it necessary to rearrange the quarters and to construct additional rooms aboard this tender. The vessel was docked and given a general overhauling, and a number of deteriorated hull and keel plates were renewed. The superintendent's quarters were rearranged on the upper and officers' quarters rearranged on the main deck. New plumbing, heating, and electric wiring were provided. The boilers were extensively repaired by installing new sections of wrapper sheets and electric welding in the combustion chamber and patching. General repairs to the mechanical equipment were effected; repairs made to ash ejector, centrifugal pump, derrick hoister, feed water heater, shafts, sleeves, etc.

Cost.—The work was done from general expenses, Lighthouse Service, 1919, at a cost of \$30,089. It was started February 10, 1919, and completed September 13, 1919.

BOILERS AND REPAIRS, LIGHTHOUSE TENDER "JUNIPER."

Purpose.—New boilers of the water-tube type were installed on this vessel, displacing the old water-tube boiler worn out in service. At the same time the vessel was docked and given a general overhauling. New propellers and tail shafts were installed, new keel and hull plates were fitted; fresh-water tanks installed, smoke-stack furnished and fitted. A new lamp locker was built in the ship.

Cost.—The work was carried out under general expense appropriation, the total cost being \$16,345. It was started November 13, 1919, and completed February 7, 1920.

IMPROVEMENTS AND REPAIRS, LIGHTHOUSE TENDER "MANGROVE."

Purpose.—To generally overhaul and reconstruct the vessel, provide adequate accommodations for inspecting officers, officers and crew of the vessel, and suitable space for the installation of new boilers and modern hoisting gear for handling buoys and supplies, and the installation of radio apparatus. The vessel was docked and given an extensive overhauling. A shoe was fitted over the stem, and the keel shoeing was renewed for practically its entire length. Extensive renewals were made to keelson, longitudinals, frames, and bulkheads, and a number of new shell plates were fitted. New boiler foundations were constructed and two new water-tube boilers and smokestack installed, auxiliary machinery was overhauled and steam and exhaust piping rearranged and renewed. Sanitary and heating systems were renewed throughout. The main engines and condenser were overhauled and the steering gear rearranged. The vessel was stripped to the main deck beams and rebuilt, arrangement of main deck house, pilot house, and master's room, and the superintendent's and radio quarters were changed to provide more suitable arrangement. Steel skylights were fitted, also a new steel foremast and standing and running rigging. The electric lighting generators were thoroughly overhauled, and a complete new lighting system installed. New engine room telegraph systems, bell pulls, and call bells were installed. New hawse pipes for stockless anchors were fitted, the main guards were renewed, and buoy port padding renewed or repaired. The arrangement of the main deck was changed to provide for open gangway aft in way of the officers' quarters. The vessel is new from the main deck up, and with the exception of upper deck houses, which are of cypress, all new construction is of steel, including rails.

Cost.—The work was done at the navy yard, Charleston, S. C., partly from general expenses, Lighthouse Service, and partly by funds obtained from the Navy Department.

Work was started June 22, 1918, and completed December 22, 1919, at a cost to date of \$189,361.

ARANSAS PASS LIGHT STATION, TEX.

Purpose.—A double dwelling for two keepers, with necessary outbuildings, wharf, and walks, were rebuilt to replace structures damaged and destroyed in hurricane of August 16, 1918.

Site.—The structures were erected in the marsh near sites of former structures, the dwelling being located about 30 feet southwest of the brick tower which had not been destroyed. The light station is located on the bayou at east end of Harbor Island, about 6 miles from the town of Aransas Pass, Tex.

Structures.—The dwelling is of hollow-tile construction, with 6 rooms, 3 rooms for each keeper, with storerooms, closets, and fireplaces. The exterior walls are 8-inch hollow tile, plastered outside with cement mortar stucco. The partition walls are 4-inch hollow tile, the interior walls and ceiling being plastered with patent plaster. The dwelling is elevated about 11 feet above the ground line and supported on 20 cast-iron columns, each resting on a footing of concrete, capping a 19-foot creosoted yellow pine pile at a depth of 5 feet below ground level. The sills of structure are double 12-inch steel channels. The entire space under dwelling is paved with a concrete pavement 6 inches thick. The roof is covered with asbestos shingles and extends out over the gallery, running the full length of three sides of main dwelling, the kitchens are separated from main dwelling by a covered gallery 4 feet wide. The dwelling is screened throughout. The kitchens are provided with sinks, the water supplied from 9-foot 6-inch diameter cypress cisterns supported on brick foundations with concrete footings. The oil house was built of brick, with brick footings resting on a foundation of four 12 foot creosoted piles with 12 by 12 inch caps. The floor was made of concrete resting on a sand fill 5 feet above marsh level, and the roof covered with asbestos shingles. The two-compartment privy is a frame structure with brick foundation and vaults resting on a creosoted pile and timber foundation. The wharf is 6 feet wide and 30 feet long, running parallel with the bank of the bayou, and is supported on piles 8 inches square in water 6 feet deep. The walk from wharf to tower dwelling and oil house is 5 feet wide and approximately 270 feet long. It is 5 feet above ground level. The entire wharf and walk except the decking is creosoted long leaf yellow pine.

The work was commenced in May, 1918, and practically completed in September, 1919. The work was done by contract under the act approved October 6, 1917, appropriating \$20,000 for the purpose.

Cost.—The total cost of the dwellings, outbuildings, wharf, walks, etc., was \$19,940.95.

NOTE.—The former temporary dwelling was destroyed by hurricane, together with the outbuildings, and damage was sustained by the wharf and walks two days after new station was practically completed in September, 1919. The dwelling was not seriously damaged.

AIDS TO NAVIGATION, MISSISSIPPI RIVER, LA.

Purpose.—For improving the lights on the Mississippi River below New Orleans which were considered inadequate for the growing commerce of the river, being exhibited from insecure posts and hung too low. Twenty-five lights are included in the new system, 19 post lantern lights and 1 lens lantern light were rebuilt and 5 new lights were established. The new lights are: Huling, West Pointe a La Hache, Deer Range, Belair, and Oak Point Lights, La.

Site.—All lights are located on the crown of the levee (except English Turn Bend, erected on the bank outside of levee), 20 lights being in locations of former wooden structures and 5 lights established at points mentioned above, to improve the navigation of river.

Structures.—Consist of 25 standard 31-foot structural steel towers 32 feet 8 inches from base to top of lantern table. The towers are 6 feet 10 inches square at the base and are provided with a platform at the top from which the lantern is exhibited. There is a steel accumulator house at base of each tower, now used for storage of mineral oil, but will house acetylene tanks in the future when the lights are made automatic. Each tower rests on a reinforced concrete block 9 feet square by 2 feet thick, with two footings 1 foot thick extending 2 feet into the levee.

Illuminating apparatus.—Consists of 1-day lens lanterns using wick lamps, and kerosene for the illuminant. They all show fixed lights, 19 white and 6 red, having 160 and 50 candlepower, respectively. The focal planes vary in height according to location, between 37 and 49 feet above the water.

Cost.—The work was carried out under the act approved July 1, 1916, appropriating \$50,000 for the purpose. The total cost of the work to date is \$39,440.69. The towers were built by contract and the work of erection was done by hired labor and the purchase of materials. It was commenced in July, 1917, and practically completed in June, 1919.

GALVESTON JETTY LIGHT AND FOG SIGNAL STATION, TEX.

Purpose.—The light station was established to mark the entrance into Galveston Harbor and to guide vessels clear of the jetty.

Site.—The station is located at Galveston Entrance, about 7 miles from the city of Galveston, Tex., on the south rock jetty, about one-fourth mile inshore of its easterly end.

Structure.—The lighthouse is a cylindrical tower of cement plaster on a steel frame, resting upon a skeleton steel substructure supported on nine 10-inch diameter iron foundation piles, 22 feet on centers, driven through the rocks of the jetty. The steel substructure is 44 by 44 feet, rising to 42 feet 11 inches, to a platform, with baluster railing. Surmounting this structure is the cylindrical tower 23 feet 4 inches in diameter, rising 31 feet high to a watch room floor and roof. From this level, 74 feet 11 inches above mean water, a cylindrical watch room 13 feet diameter rises 11 feet 3 inches to the floor level of the lantern gallery, which is surmounted by a standard 3d-order lantern. The substructure is constructed of 8-inch Z-bar columns, 12-inch I-beam struts, with 1½-inch and 2-inch diameter tie-rod bracing. Since the superstructure was completed (due to damage in the hurricane of 1915, which bent the lower struts of substructure), intermediate steel struts have been installed and the structure stiffened by placing a concrete block 49 feet square around foundation piles, varying in thickness from 5 feet 6 inches to 15 feet on the southerly side; the Z-bar columns were encased with concrete to a height of 17 feet up to the second tier of struts. Riprap protection has been placed outside the concrete block. The tower has a skeleton steel framework formed of eight 10-inch I-beam columns with 5-inch I-beam intermediate columns. On each floor heavy I-beams radiate from the center column to all other columns and are secured with brackets, gussets, and segmental braces. The skeleton framework is encased with cement plaster 2 inches thick on a form of ribbed expanded metal for both interior and exterior walls, which have an air space of 5 inches between them. The floors are of wood and staircase of cast iron. The watch room has no intermediate columns, but is otherwise similarly constructed with smaller members in its skeleton steel framework. Eight concrete pilasters are formed on the exterior walls of both the main tower and watch room, with copper cornices surrounding the roof of tower and lantern gallery. The tower has three floors, watch room and lantern, and accommodates three keepers. On the first floor are the oil room and engine room; on second floor, kitchen, bedroom, bathroom, and closet; on third floor, two bedrooms and two closets.

Illuminating apparatus.—The illuminating apparatus is a 3d-order, revolving lens with 1,000-pound mercury float on pedestal, using a type "B," 55 millimeter, incandescent oil-vapor outfit. The light characteristic is flashing alternating white and red every 10 seconds, white flash 1 second, eclipse 4 seconds, red flash 1 second, eclipse 4 seconds, with candlepower of 23,000. The lens is so constructed that the red and white flashes will have the same intensity of light. The focal plane is 91 feet above water, and the light is visible 15 miles.

Fog signal.—A temporary fog bell struck by machinery will be installed pending an additional appropriation for a permanent fog signal of more powerful type, for which an estimate has been submitted.

Quarters.—Three keepers have quarters in the main tower.

Cost.—The station was established under the acts approved June 11, 1896, and May 28, 1908, appropriating \$45,000 in all for the work. In completing the structure, the amount expended to June 30, 1920, is \$44,901.13. The metal work was fabricated under contract, and the erection and work at the site carried out by purchase of materials and hired labor. Due to long delays occasioned by doubt as to proper site, extension of jetty, and damage caused by storms, the work proceeded very slowly. The light went into commission on November 12, 1918.

SOUTH PASS WEST JETTY RANGE FRONT LIGHT AND FOG SIGNAL STATION, LA.

Purpose.—It was found necessary to provide a more efficient fog signal to mark the entrance to South Pass of Mississippi River, during foggy weather, in the location of the South Pass West Jetty Range Front Light. There was a fog bell on the east bank of the river at South Pass East Jetty Light Station, but it was not powerful enough, and its location was not as satisfactory as the one now on the west side.

Site.—The new structure is in the marsh near the edge of the west bank of the river, about 25 yards west-northwesterly of the former range front light, located about 2 miles below the town of Port Eads, La.

Structure.—A new frame structure was erected as a light and fog signal. The structure is 24 feet square, founded on sixteen 12 by 12 inch sawn long-leaf southern

yellow-pine piles creosoted 20 pounds per cubic foot. The bents are 12 feet above the marsh and are braced with 3 by 10 inch cross braces and capped by 12 by 12 inch caps. The floor is tongue-and-groove cypress 2½ inches thick laid on 1½-inch tongue-and-groove subfloor placed diagonally on 6 by 12 inch joists. The structure was painted white with a central vertical black stripe on the range face. A 500-foot raised walk 6 feet wide on creosoted round piles was built through the marsh connecting the station to a boat landing. The rear light of the range is a square, pyramidal slatted structure on piles, which was increased in height to 50 feet above water.

Illuminating apparatus.—The illuminating apparatus is a fixed white lens lantern light shown 35 feet above high water from the roof of the new fog-signal house. This is the front light of the range, is 160 candlepower, and is visible 9 miles. The rear light is an acetylene reflector light of 2,200 candlepower, and is visible 12 miles.

Fog signal.—The fog signal is a type "F" air diaphone, the characteristic of which is a blast of 2 seconds every 20 seconds. The fog signal and machinery are in duplicate. Air is supplied by 15 horsepower horizontal, inclosed cylinder kerosene engine, operating at a speed of 350 revolutions per minute connected with a silent chain drive to single-cylinder compressors, each with a piston displacement of 114 cubic feet of free air per minute.

Cost.—This work was carried out practically under the appropriations for general expenses, 1918 and 1919. The total cost of fog-signal installation, fog-signal house, and walk was \$12,500.55. Actual work was commenced in August, 1919, and completed December 11, 1919.

AIDS TO NAVIGATION, HURON, OHIO.

Purpose.—To provide a light on the west pier to serve with the existing light at the outer end of the pier, to guide vessels approaching the harbor. The light was placed in commission August 29, 1919.

Site.—The new tower is located at the bend of west pier, about 400 yards from Huron Lighthouse.

Structure.—It is a square, pyramidal skeleton steel tower, 65 feet high, with a railed platform, 5½ feet square at the top. The tower is anchored on a concrete-block foundation.

Illuminating apparatus.—This consists of duplicate 14-inch silvered mirror head-light reflectors mounted on a table at top of tower. The characteristic of the light is fixed red, of 6,700 candlepower, and the focal plane is 71 feet above water. The illuminant is electricity, current being obtained from city power. In case of failure of one lamp, the reserve lamp is lighted by means of a relay.

Cost.—The act of June 12, 1917, appropriated \$4,500 for this project. The total cost to June 30, 1920, \$4,092.42.

NEW BOILERS FOR LIGHTHOUSE TENDER "AMARANTH."

New boilers of the Scotch marine type for this vessel were constructed under contract and their installation in the vessel carried out during the closed navigation season of 1919 and 1920 by the construction force of the district.

In the installation of the new boilers a change was made in the arrangement of fire hold and coal bunkers whereby the two boilers were placed athwartship (side by side) instead of fore and aft as heretofore. The coal bunkers which were previously on each side of the fire hold were combined into one athwartship bunker of equivalent capacity coaled through a chute from the upper deck. This change greatly facilitates coaling at the various docks on the lakes where chutes are in use and makes it possible to take on full bunker capacity in a minimum of time and without swinging the steamer. The fire hold is much more commodious than formerly and is also much more comfortable, as the best of ventilation is secured. The arrangement has also improved the stability of the vessel through lowering the bunker floors and has proved to be advantageous in every respect.

In connection with this work considerable renewal of decking was carried out and the arrangement of crew's quarters and mess room in the way of the work improved. Complete new breeching and new saddles were constructed and installed.

All of the above work was carried out at the Detroit Lighthouse Depot, except the work of lifting boilers from and into the vessel, which was done at a local shipyard.

The work was commenced promptly at the close of navigation and the vessel was again in service when navigation opened in the spring.

Cost.—The cost of the boilers as constructed under contract was \$28,000 and the cost of installation and other incidental work carried out at the same time was \$17,500, making the total cost of the work \$45,500. All was paid from the general-expense appropriation.

WHITE SHOAL LIGHT STATION, MICH.

See description of station published in Annual Report of Commissioner of Lighthouses, June 30, 1912, page 97. Total cost at that date, \$224,563.83.

The work done since that time has consisted of minor added features as follows:

Riprap placed about crib in August, 1914.

Auxiliary acetylene light for winter service, December, 1914.

Air-power hoists on three boat cranes, October, 1919.

Additional mo or boat, June, 1920.

Project has now been completed.

Total amount expended to June 30, 1920, \$226,858.95.

MANITOWOC (NORTH) BREAKWATER, WIS.

Purpose.—To replace old and very badly decayed frame light and fog-signal building at outer end of North Breakwater and to replace old worn out fog-signal boilers and steam fog whistle and inadequate oil light with improved aids suitable to the important commerce entering this port.

Site.—Station stands on outer end of North Breakwater in the same location occupied by old structure, which was removed.

Structure.—The structure is built as follows: A hollow reinforced concrete foundation pier, 22 by 48 feet 6 inches by 11 feet 2 inches high, stands on the United States engineers' concrete breakwater, which breakwater has a height of 4 feet and a width of 24 feet. The building is of one-fourth inch steel plate, with I-beam studding and floor beams and s.ands on the concrete foundation pier. It has outside dimensions of 19 by 34 feet for first story and 19 by 19 feet for second story. The projecting ends of the first story are roofed with a low-sloping hip roof of steel plate. The roof of the second story is of steel plate; nearly level, and supports the round steel diaphone room, 12 feet 4½ inches diameter, on top of which is the round cast-iron lantern deck and cast-iron lantern house. Focal plane is 46 feet above the top of the reinforced-concrete breakwater. Basement is used for warm-air heating plant, coal storage, and boat house. The first story is lined with hollow tile and is used as power room. The second story is insulated with flaxlinum and lined with plaster on metal lath, and is fitted with shower bath, lavatory and water-closet, and furnished with desk and chairs. The round diaphone room constitutes the third floor and is insulated with flaxlinum and lined with plaster on hyrib. Stairs are of structural steel.

Illuminating apparatus.—Consists of a 4th-order 360° lens, equipped with 200-watt gas-filled Mazda lamp, showing a fixed red light of 2,000 candles, visible 14 miles. The focal plane is 52 feet above the water.

Fog signal.—A single type "F" diaphone is installed in diaphone room and is supplied with air at 30 pounds' pressure. Compressed air is furnished by a 2-cylinder, vertical, single-action, air-cooled air compressor, driven by a 15-horsepower electric motor, 3-phase, 440-volt. For reserve emergency use a horizontal belt-driven air compressor, driven by a 15-horsepower horizontal oil engine, is provided. Compressed air is cooled and dried by passing it through an inside pipe coil, through a tank, through an outside pipe coil, and thence into a second air tank, whence air goes up to diaphone. Water for cooling reserve compressor and oil engine and for domestic purposes is furnished by an air-displacement pump. A small steel switch house is located at inner end of breakwater. The aerial electric lines of the municipal electric plant deliver 3-phase current at switch house at 2,200 volts, thence through a transformer at 440 volts to the cable, which joins the switch house with light station, 1,800 feet long. Cable is of heavy construction, lead covered, and placed in a 2-inch galvanized-pipe conduit secured to the top of old steel elevated walk along the breakwater.

Lens light and fog signal are normally operated by switches in the power room, but they may also be controled by switches placed in the switch house at shore end of breakwater, such use being intended more particularly for daytime operation.

Cost.—The work was constructed under the act of June 12, 1917, appropriating \$21,000 and the supplementary appropriation of \$9,000 carried by the sundry civil act approved July 19, 1919. The cost was \$27,209.96. Construction was commenced in May, 1918, was subject to a delay of some six months in 1919, owing to the exhaustion of original appropriation, and was completed in June, 1920. Temporary oil light established in structure, November 15, 1918. Permanent electric light established, December 13, 1919. Diaphone fog signal established, December 13, 1919.

REPAIRS AND IMPROVEMENTS, TENDER "CEDAR."

Purpose.—To dock vessel for cleaning and painting bottom, to make repairs to offset deterioration or damage, and to make improvements for increasing the efficiency of the vessel for its work or to better living conditions for officers and crew.

Work done.—Docked vessel, cleaned and painted bottom; redrove, calked, or electric welded defective rivets and calked leaking seams of underwater hull: installed by-pass auxiliary steam line in engine room; altered and improved toilets for officers and crew; increased pitch of propeller; altered and improved quadrants of hoist controls; altered refrigerating room preparatory to installing refrigerating machine; electric welded leaking rivets of furnace fronts of boilers; installed speaking tube from pilot house to master's quarters; installed piping, vents, valves, etc., to fit double-bottom tanks under boiler room for carrying fuel oil; installed by-pass for double-bottom compartments; renewed hull zincs and installed additional zincs; overhauled, repaired, and improved radio plant; calked seams and rivets of upper deck waterway; made new set propeller blades for spare; made various minor repairs and improvements. Pitch of propeller was measured.

Cost.—The amount expended for the above work from the appropriation General expenses, 1920, was \$11,195.47. The work was done at the navy yard, Mare Island, Calif., on the basis of actual cost, and payment was made by transfer of funds.

AIDS TO NAVIGATION, ALASKA.

Purpose.—To meet the demands of the increasing commerce and to continue the work of establishing efficient aids to navigation, 12 acetylene lights and 3 gas buoys were established at various points in Alaskan waters during the fiscal year ending June 30, 1920. Data relative to these aids is shown in tabular form on the following page.

Quarters.—No quarters were provided. All acetylene lights are of the unwatched type, using compressed acetylene in acetone, supplied from batteries of steel cylinders, which contain a sufficient supply of gas to operate the light continuously between visits of lighthouse tenders.

Cost.—The amount of \$4,029.12 was expended from the appropriation of June 12, 1917, and of \$50,921.26, from the appropriation of June 19, 1919, during the fiscal year 1920.

Name of light.	Locality.	Structure.	Illuminating apparatus.	Characteristic.	Intensity of light, in candles.	Focal plane above mean high water, seen in feet.	Miles	Approximate cost.	Date of establishment.
Angle Point	Revillagigedo Channel	White wooden house.	200-millimeter acetylene lens lantern.	Group flashing white (flash 0.5 sec., eclipse 1.5 sec., flash 0.5 sec., eclipse 7.5 sec.).	130	51	9	\$1,305.85	Feb. 5, 1920
Bligh Island Reef gas and bell buoy.	Prince William Sound.	Red cylindrical skeleton superstructure.	do.	Flashing white every 10 sec. (flash 1 sec. duration).	130	12	8	.....	Aug. 9, 1919
Cape Edwards Entrance.	Kukkan Bay.	White wooden house.	do.	Flashing white (flash 0.3 sec., eclipse 2.7 sec.).	130	39	9	1,143.37	May 24, 1920
Cape Ommaney.	Chatham Strait.	do.	375-millimeter acetylene lens lantern.	Flashing white (flash 3 sec., eclipse 27 sec.).	310	90	11	2,700.00	June 13, 1920
Cape Pankof.	Unimak Island.	do.	do.	Flashing white (flash 1. sec., eclipse 9 sec.).	310	82	11	2,524.95	July 21, 1919
Favorite Reef gas and bell buoy, 2.	Stephens Passage.	Red cylindrical skeleton superstructure.	200-millimeter acetylene lens lantern.	Flashing white (flash 0.3 sec., eclipse 2.7 sec.).	130	12	8	4,390.00	Sept. 26, 1919
Hanks Island Rock gas and bell buoy, 1.	Prince William Sound.	Black cylindrical skeleton superstructure.	do.	do.	130	12	8	4,385.66	Aug. 14, 1919
Inner Point Sophia.	Icy Strait.	White wooden house on skeleton tower.	do.	Flashing white (flash 0.6 sec., eclipse 5.4 sec.).	130	29	9	1,103.82	Mar. 15, 1920
Lisianski Strait Entrance.	Lisianski Strait.	White wooden house.	do.	Flashing white (flash 1 sec., eclipse 9 sec.).	130	45	9	1,773.41	Mar. 17, 1920
New Year Islands.	Prince William Sound.	do.	do.	do.	130	20	9	1,996.16	Aug. 7, 1919
Old Sitka Rocks.	Sitka Sound.	White wooden house on skeleton tower.	150-millimeter acetylene lens lantern.	Flashing white (flash 0.6 sec., eclipse 5.4 sec.).	10	29	9	532.50	Jan. 26, 1919
Pastol Bay Front.	Yukon River.	White wooden house.	200-millimeter acetylene lens lantern.	Flashing white (flash 0.3 sec., eclipse 2.7 sec.).	130	10	9	1,075.54	July 29, 1919
Point Colpoys.	Sumner Strait.	do.	do.	Flashing white (flash 1 sec., eclipse 9 sec.).	130	15	9	1,164.72	Feb. 1, 1920
Red Bluff Bay.	Chatham Strait.	do.	150-millimeter acetylene lens lantern.	Flashing white (flash 0.6 sec., eclipse 5.4 sec.).	10	18	9	350.00	May 29, 1920
Rose Inlet.	Tlevak Strait.	do.	do.	do.	10	23	9	503.07	Feb. 21, 1920

HUMBOLDT FOG SIGNAL STATION, CALIF.

Purpose.—Station was established in 1908; present project consisted in building about 956 linear feet of protection bulkheads to prevent erosion of sand spit by action of heavy seas, which menaced the station buildings; also needed repairs to keeper's old quarters to make more habitable.

Site.—The station is located on a sand spit on north side of entrance to Humboldt Bay, about 6 feet above mean high water, and the reservation contains about 197 acres.

Structure.—The protection bulkheads are constructed as follows: Twelve-inch piles, 8 feet center to center, 6 by 8 inch wales, 3 by 6 inch back stringers, 3 by 12 inches by 16 feet sheet piling with 2 by 6 inches by 12 feet battens on each side of joints of sheet piling; all thoroughly bolted together.

Quarters.—Bath, toilet, and laundry fixtures were installed and a water tank on tower with gasoline power pump was installed for service water and fire protection purposes.

Cost.—The bulkheads were built under contract, but the repairs to quarters were made by hired labor and purchase of material under contract. Cost of project was \$12,159. Work was completed March, 1920.

SUMMARY OF IMPORTANT CONSTRUCTION AND REPAIR WORK UNDER GENERAL APPROPRIATIONS COMPLETED DURING FISCAL YEAR 1920.

Station.	Cost.	Character of work.
FIRST DISTRICT.		
Tender Hibiscus.....	\$11,193.11	Docking vessel, repairing hull, machinery, boilers, mounting line-throwing gun, and general minor repairs.
Tender Zizania.....	21,243.73	Docking vessel, repairing hull, machinery, pumps, mast, rigging, and houses.
Manana Island Fog Signal Station, Me.	6,504.99	Renewing fog-signal apparatus, improving buildings, etc.
Avery Rock Light Station, Me.....	2,001.26	Repairing dwellings, tower, boat slip, and constructing timber bulkhead to protect station against sea.
SECOND DISTRICT.		
Woods Hole Lighthouse Depot, Mass.	12,998.00	Rebuilding wharf.
Canal Channel Light No. 16.....	1,604.38	Raised riprap mound, built concrete slab and lantern house.
Canal Channel Light No. 15.....	2,115.44	Do.
Tender Azalea.....	3,752.75	Removing old and fitting new water tanks; docking, miscellaneous repairs to hull, etc.
Tender Mayflower.....	1,088.06	Repairing boilers, pumps, and engines.
Light Vessel No. 20.....	2,363.65	Installing new windlass, repairing rudder, deck, and caulking.
Light Vessel No. 66.....	4,857.09	Docking, miscellaneous repairs to boiler and hull.
Relief Light Vessel No. 90.....	1,471.00	Repairing boilers.
THIRD DISTRICT.		
General Lighthouse Depot.....	10,896.00	Reinforcing concrete bulkhead of sea wall; fire doors for oil house, constructing scale house and garage, and improvements of office building.
Barnegat Light Station, N. J.....	4,676.00	100-foot steel tower constructed and acetylene apparatus purchased.
Canarsie Dike Light, N. Y.....	1,454.00	Changed from fixed red oil light to flashing white acetylene.
Essex Reef Light, Conn.....	1,155.00	Changed from fixed oil to flashing acetylene.
Newark Bay Lights Nos. 1, 2, 3, N. J.	1,528.00	Concrete foundations and skeleton steel towers constructed in place of present portable tank houses.
Montauk Point Light Station, N. Y.	2,121.00	New leaders and gutters provided and installed; roofs reshingled; stairs, floors, and plaster in quarters of three keepers repaired.
Raritan River Lights Nos. 1, 2, 3, N. J.	6,019.00	Concrete foundations and steel towers constructed and lights changed from fixed oil to flashing acetylene.
Warwick Light Station, R. I.....	4,342.00	Reservation protected from erosion caused by sea and rain.
Barge Elm.....	4,017.00	New tail shaft made and installed; other work to hull and machinery, and equipment furnished to complete vessel for service.
Tender Larkspur.....	1,054.00	Docked to paint bottom and replace broken wheel.
Tender Pansy.....	2,464.60	General repairs made to hull and machinery and two new searchlights installed.

SUMMARY OF IMPORTANT CONSTRUCTION AND REPAIR WORK UNDER GENERAL APPROPRIATIONS COMPLETED DURING FISCAL YEAR 1920—Continued.

Station.	Cost.	Character of work.
THIRD DISTRICT—continued.		
Bartlett Reef Light Vessel No. 13..	\$1,085.00	Vessel docked for repairing sheathing metal, etc.; 45 fathoms mooring chain renewed, and other repairs made to hull and machinery.
Relief Light Vessel No. 16.....	4,325.00	Deck house built for wireless room and galley. Vessel docked and sheathing metal repaired. Mooring chain overhauled and other repairs made to hull and machinery.
Ram Island Reef Light Vessel No. 23.	4,878.00	Masts and oil light removed and steel tower with flashing acetylene light installed, and general repairs made to vessel.
Brenton Reef Light Vessel No. 39...	5,906.00	Vessel docked and sheathing metal repaired; overhaul, repair of mooring chain, etc., and minor repairs to hull and machinery.
Relief Light Vessel No. 78.....	3,290.00	General minor repairs made to hull and machinery.
Five-Fathom Bank Light Vessel No. 79.	7,885.00	Vessel docked for painting bottom, overhaul, repair mooring chain, and general repairs to hull and machinery; purchased new boiler tubes for both boilers; evaporator shell renewed, and other minor repairs made.
Ambrose Channel Light Vessel No. 87.	7,740.00	Docking, painting, and general repairs made to hull and machinery.
FOURTH DISTRICT.		
Delaware Breakwater Range Rear (unused) Light Station, Del.	2,650.00	Structural steel and cast-iron tower dismantled and put on cars for rail shipment.
Mud Island Range Front Light, Pa..	1,057.08	Light changed from electric to acetylene and intensity reduced.
Cape Henlopen Light Station, Del..	1,924.31	Brush placed in windrows on the slopes and in valleys of the sand dune around the tower foundation.
Edgemoor Lighthouse Depot, Del..	2,190.27	About 28 decayed and damaged fender and cluster piles removed and new piles driven.
Lighthouse tender Iris.....	19,000.00	Docking, painting, and general repairs.
Marcus Hook Range Rear Light Station, Del.	2,954.00	Driveway, fence, drains, and concrete walks installed. Lawn graded and seeded.
FIFTH DISTRICT.		
Cape Hatteras Light Station, N. C. .	7,530.36	General repairs.
Craney Island Light Station, Va....	6,008.00	Placing riprap stone protection.
Cherrystone Bar Light, Va.....	4,500.00	Do.
Currituck Beach Light Station, N. C.	7,438.00	Moving dwelling, rebuilding wharf, general repairs.
Portsmouth Lighthouse Depot Annex, Va.	2,061.15	Extend wharf.
New Point Comfort Light Station, Va	1,118.00	Change light from oil to acetylene.
Jones Point Light Station, Va.....	1,001.08	Do.
Minor Lights.....	7,916.00	Restoring post lights carried away by ice.
Tender Maple.....	30,089.00	Docking, painting, repairs to hull, machinery, and boilers.
Tender Orchid.....	8,886.00	Docking, painting, general repairs.
Cape Lookout Shoals Light Vessel No. 80.	1,717.00	Docking, painting, minor repairs.
Tender Laurel.....	5,174.25	Docking, repairs, and improvements to hull and machinery.
Tender Columbine.....	51,556.00	Docking, painting, rearrangement of quarters.
Tender Juniper.....	16,345.00	Docking, painting, general repairs, including installation of new boilers.
Relief Light Vessel No. 49.....	1,621.10	Docking, painting, installation of new mainmast.
Tender Maple.....	1,285.00	Installing patch on boiler.
Barge Vine.....	6,340.46	Docking, resheathing, and caulking hull.
Tender Jessamine.....	3,851.80	Docking, painting, repairs to hull and machinery.
Cape Charles Light Vessel No. 101..	1,858.39	Docking, painting, minor repairs.
Buoyage.....	2,707.58	120 wooden spar buoys, including ironing.
SIXTH DISTRICT.		
Cape Fear Light Station, N. C.	4,560.73	Installed 6,000-pound mercury float, pedestal, and type "D" clock.
St. Johns River, Fla.....	4,086.83	Rebuilt and repaired all light structures and beacons above Jacksonville, Fla. (43 structures).
Tender Cypress.....	2,751.00	Docking, cleaning, painting, and general repairs to hull, machinery, and boilers.
Tender Mangrove.....	190,873.00	Docking, cleaning, painting, and extensive repairs and alterations, including practically rebuilding of one main deck, installation of two new water-tube boilers, new stack, new steel foremast derrick hoisting gear, heating, sanitary, fresh water and electric lighting systems, and standing and running rigging.

¹ Approximate.

SUMMARY OF IMPORTANT CONSTRUCTION AND REPAIR WORK UNDER GENERAL APPROPRIATIONS COMPLETED DURING FISCAL YEAR 1920—Continued.

Station.	Cost.	Character of work.
SIXTH DISTRICT—continued.		
Frying-Pan Shoals Light Vessel No. 94.	\$5,838.00	Docking, cleaning, painting; general repairs to hull and machinery; alterations to lantern mast and installation of A. G. A. masthead light.
Brunswick Light Vessel No. 84.....	4,927.00	Docking, cleaning, painting; general repairs to hull, machinery, and boilers, including new spar deck pipe rail, repairs to ventilators, boat davits, cargo port doors, toilets, windlass, air pump, rudder, motor boat, and boiler tubes.
Charleston Light Vessel No. 34.....	1,083.00	Docking, cleaning, renewal of a portion of yellow metal sheathing, new rudder, new chain plates for mainmast back stays, test holes, and examination of planking.
Martins Industry Light Vessel No. 1.	2,618.00	Docking, cleaning, painting; renewal of a portion of galvanized-iron sheathing; two new whale boats; minor repairs to hull.
Tender Palmetto.....	7,687.00	Installed two rudders and electric lighting plant; minor repairs to hull and machinery.
SEVENTH DISTRICT.		
Tender Ivy.....	2,833.00	Docked, cleaned, and painted; electric-welded boiler; renewed mainmast; repaired cargo boat and installed gasoline motor; overhauled machinery.
Key West Depot, Fla.....	4,486.00	Installed 25 new creosoted piles, renewed 26 cap logs and 140 stringers, and renewed or replaced 10,600 square feet of decking.
Anclote Keys Light Station, Fla....	2,119.00	Renewed two 5,000-gallon cypress water tanks; renewed 210 feet of wharf; repaired boathouse and boat ways.
Beacons and unattended lights.....	1,317.00	Made minor repairs and painted.
EIGHTH DISTRICT.		
Amite River Light Station, La.....	3,497.44	Renewed entire foundation of dwelling above water sill; minor repairs to station.
Calcasieu Range Front Light, La....	1,912.99	Rebuilt four iron-cased pile structure.
Heald Bank Light Vessel No. 81....	4,654.09	Docking, painting, and general repairs.
Houston Channel Buoys, Texas.....	2,000.00	Established 50 second-class spar buoys.
South Pass Light Vessel No. 102.....	1,031.44	Docking, painting, and minor repairs.
South Pass West Jetty Range Front Light and Fog Signal Station, La.	9,830.09	Built structure for light and fog-signal station, installing diaphone fog signal.
Southwest Pass East Jetty Light, La.	1,078.50	Rebuilt pyramidal superstructure, increasing height.
NINTH DISTRICT.		
Cucaracha Light Station.....	1,670.56	Structure changed, and compressed acetylene apparatus installed in place of oil gas.
TENTH DISTRICT.		
Cleveland East Entrance Light Station, Ohio.	6,473.06	Provided and installed new armored submarine cable.
Conneaut Light Station, Ohio.....	2,079.06	Provided new motor boat No. 136.
Lorain Light Station, Ohio.....	1,871.50	Provided new motor boat No. 137.
Presque Isle Light Station, Pa.....	3,322.23	Repaired inshore end of protection jetty, renewed roof on boathouse, and constructed concrete walk to connect boathouse with shore.
Tender Crocus.....	2,141.97	Provided new double funnel, repaired hawse pipe, etc.
Do.....	1,027.95	Docking, cleaning, and painting hull, etc.
ELEVENTH DISTRICT.		
Tender Amaranth.....	45,500.00	New boilers purchased and installed; renewed breeching; constructed coaling hatch; rearranged crew's quarters, etc.
Fort Gratiot Light Station, Mich....	2,793.17	Installed independent diaphone fog signal as an auxiliary to show smoke conditions in St. Clair River.
Detroit Lighthouse Depot, Mich....	2,000.00	Purchased and installed automatic electric motor-driven air compressor for yard work.
Harbor Beach Light Station, Mich..	8,382.18	Installed compressed air diaphone fog signal replacing old steam plant.
Saginaw River Range Light Station, Mich.	3,868.26	Constructed revetment of reinforced concrete around premises at rear range.
Alpena Light Station, Mich.....	3,200.00	Installed siren fog signal and made repairs to dwelling; remodeled woodshed into power house building.
Fourteen Mile Point Light Station, Mich.	2,762.61	Constructed cribs at landing dock for boat harbor.

SUMMARY OF IMPORTANT CONSTRUCTION AND REPAIR WORK UNDER GENERAL APPROPRIATIONS COMPLETED DURING FISCAL YEAR 1920—Continued.

Station.	Cost.	Character of work.
TWELFTH DISTRICT.		
Grand Haven Light Station, Mich..	\$1,745.48	Erecting steel elevated walk on 357 feet new pier.
Michigan City Light Station, Ind...	3,634.34	General repairs to dwelling, elevated walk, and fog-signal building; concrete foundation to west pier tower; also minor improvements.
Milwaukee Depot, Wis.....	2,069.54	Electric power installed for elevating supplies and freight; rebuilding dock; building new attic floor; and extending and repairing brick pavement.
Twin River Point Light Station, Wis.	10,834.19	Removed old worn-out steam fog-signal apparatus and installed oil-engine driven air compressors and type "G" diaphone; constructed a pile dock for landing material and supplies.
Kewaunee Pierhead Range, Wis....	6,041.46	Improved fog signal by changing from oil-engine driven compressors to electric driven in one unit and installed diaphone in lieu of chime air whistle.
Tender Hyacinth.....	5,309.35	General repairs and docking costing \$1,699.66 which were done between periods of Jan. 1 and June 30, 1919, and should have been reported in last report; general repairs while in winter quarters, providing wireless room and some changes in crew's quarters.
Tender Sumac.....	2,801.16	Docking and minor repairs; general repairs while in winter quarters; new propellers purchased, to be placed later.
SIXTEENTH DISTRICT.		
Tender Cedar.....	13,286.15	Docking, cleaning, and repairs.
SEVENTEENTH DISTRICT.		
New Dungeness Light Station, Wash.	4,310.68	Repairs to buildings and grounds, including installation of water system.
Tongue Point Lighthouse Depot, Oreg.	1,274.23	Repairing wharf and buildings.
Tender Manzanita.....	2,182.61	Docking, cleaning, painting, repairing steam machinery and making modifications in quarters.
Umatilla Reef Light Vessel No. 67....	3,955.79	Docking, cleaning, installing new rudder, repairing machinery, and retubing donkey boiler.
Relief Light Vessel No. 92.....	1,854.50	Entire upper deck calked and minor repairs made to machinery.
Swiftsure Bank Light Vessel No. 93..	4,659.76	Docking, cleaning, painting, minor repairs to machinery, and lamp houses built.
EIGHTEENTH DISTRICT.		
East Brother Island Light Station, Calif.	1,924.00	Rebuilding landing dock.
Farallon Light Station, Calif.....	2,848.00	Rebuilding landing dock and relaying F. S. Railroad track.
Humboldt Bay Fog Signal and Lights, Calif.	12,159.00	Building 956 linear feet protection bulkhead and installing bath, toilet, laundry, and water tank on tower at assistant-keeper's quarters.
Suisun Bay, Beacons, and Echo Boards, Calif.	1,096.00	Rebuilding beacon and echo boards at Middle Ground and Stake Point.
Rubicon Point Light, Lake Tahoe, Calif.	1,352.00	Establishment of an acetylene light; 200-millimeter AGA lantern and flasher on small lantern house, 200 feet to focal plane above lake level. Flashing white every 5 seconds.
Tender Sequoia.....	2,412.00	Docking, cleaning, painting, general overhauling, and repairs to hull, boilers, engines, and machinery.
Relief Light Vessel No. 76.....	1,060.00	Docking, cleaning, painting, and repairs to hull, boiler, engine, and machinery.
San Francisco Light Vessel No. 70....	1,815.00	Do.
NINETEENTH DISTRICT.		
Kilauea Point Light Station, Hawaii.	2,500.13	Building new concrete derrick landing platform, concrete sanitary water-closet; concrete hoisting and gas engine house; also general repairs and improvements to station and grounds.
Tender Kukui.....	1,731.00	Docking, cleaning, painting, and minor repairs, also special repairs to water tank.
Makapuu Point Light Station, Hawaii.	1,396.71	Reroofing 3 keeper's dwellings; also partial fencing of station reservation.
Kaena Point Light Station, Hawaii	2,479.84	Establishing 300 millimeter acetylene gas light on a reinforced concrete tower; also constructing 1,315 linear feet of light wooden track for station supply car.

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ANNUAL REPORT
OF THE
COMMISSIONER OF LIGHTHOUSES

TO THE
SECRETARY OF COMMERCE

FOR THE
FISCAL YEAR ENDED JUNE 30, 1921



WASHINGTON
GOVERNMENT PRINTING OFFICE
1921

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REPORT

OF THE

COMMISSIONER OF LIGHTHOUSES.

DEPARTMENT OF COMMERCE,
BUREAU OF LIGHTHOUSES,
Washington, September 15, 1921.

SIR: The following report is submitted of the operations of the Lighthouse Service for the fiscal year ended June 30, 1921:

MORE IMPORTANT ACTIVITIES OF THE LIGHTHOUSE SERVICE DURING THE YEAR.

Three radio fog-signal stations, the first in this country, were placed in commission by the Lighthouse Service on May 1, 1921. These are on Ambrose Channel Light Vessel, Fire Island Light Vessel, and at Sea Girt Lighthouse, all in the vicinity of New York Harbor. These stations are the result of experiments carried out during several years by the Bureau of Standards and the Lighthouse Service in cooperation and of the development of a practical radio compass by the former. A public demonstration of the working of these stations and of the use in connection therewith of a radio compass mounted on a vessel was given on the lighthouse tender *Tulip* in the vicinity of New York on June 27 and 28, 1921. This system should give to the navigator for the first time a means of taking in a fog, or time of low visibility, accurate bearings of invisible lighthouses and light vessels, which he may use in locating or steering his vessel, and he should be able to do this independently as he uses his magnetic compass for bearings on visible objects. When developed and its use extended, radio fog signals and the radio compass will probably be the greatest advance made in a long period in affording protection to vessels in fog and should be the means of avoiding some of the serious marine disasters now due to inability to hear or locate a fog signal under unfavorable conditions. A description of the radio fog signals and their development is given on pages 24 to 30 of this report.

Congress by the act of March 4, 1921, appropriated \$1,000,000 for vessels for the Lighthouse Service, a part of the \$5,000,000 vessel rebuilding program which was authorized by the act of June 5, 1920. Plans and specifications were promptly prepared and bids opened on June 21, 1920. They were found so favorable that it was possible to contract for five identical light vessels at an average cost of \$184,000 each. The need of additional vessels is fully stated on pages 9 to 11 of this report.

After an intermission of three years on account of war conditions a conference of the superintendents of the 16 coast and lake lighthouse districts and the principal officers of the Lighthouse Service was held in Washington October 11 to 15, 1920. All of the superintendents were present, including those in charge of the Alaska, Hawaii, and Porto Rico districts. There was a general consideration of technical and administrative problems affecting the service and interchange of experience and results.

During the year the new lighthouse at Point Borinquen, the northwestern extremity of Porto Rico, was finished, complete new systems of aids to navigation were established for Keweenaw Waterway, Lake Superior, and for Fighting Island Channel, Detroit River, Mich., and the new plate shop and coal shed at the general lighthouse depot on Staten Island, N. Y., were completed. Important improvements and construction were in progress at lighthouse depots at Chelsea, Mass.; Galveston, Tex.; Detroit, Mich.; and Ketchikan, Alaska; on aids in the Hudson, St. Johns, Detroit, Mississippi, and St. Marys Rivers; the eastern shore of Chesapeake Bay; and at light stations at Point Jiguero, P. R.; the Florida Reefs; Fairport and Conneaut Harbors, Ohio; Indiana Harbor, Ind.; and Point Vincente, Calif. The total number of aids to navigation maintained by the United States Lighthouse Service at the end of the fiscal year was 16,356, a net increase during the year of 31. There was an increase of 47 in the number of gas buoys. In Alaska there was an increase of 13 aids, of which 10 were lights and 3 gas buoys. The total number of aids to navigation in Alaska is now 548.

SUMMARY OF MORE URGENT NEEDS OF THE LIGHTHOUSE SERVICE.

1. Revision of pay schedules is urgently needed so as to bring about a just relation according to duties and responsibilities between the various employments in this service, and in comparison with other Government and outside employment, and to take account of the depreciated purchasing power of the dollar; most of the readjustments of pay that it has been possible to make under the appropriations have not met the needs, and certain classes, particularly the bureau force in Washington, have shared little or not at all in advances since conditions before the war. The decreases in the cost of living that have occurred do not materially relieve the difficulty and will not so long as the salaries above referred to are very much less than those paid in other branches of the Government for similar services.

2. Provision is urgently needed for replacing many of the vessels of the Lighthouse Service which have been lost or worn out in service or which will soon have to be condemned, as well as for adding reasonable vessel equipment to meet the considerable increase of the past 10 years in the aids to navigation maintained. The provision recently made covers only a small proportion of the needs of the service in this respect.

3. Provision is greatly needed for improved depot facilities in several of the districts, particularly at or near Norfolk, Va.; Key West, Fla.; Honolulu, Hawaii; and Newport, R. I.; and additional funds are needed for the completion of the important depots at Boston,

Mass.; Charleston, S. C.; Detroit, Mich.; San Juan, P. R.; and Ketchikan, Alaska.

4. Legislation is greatly needed extending the retirement system in the Lighthouse Service to cases of disability incident to the work other than injury received in the line of duty, already provided for.

5. Legislation is important to better define the relations of the Lighthouse Service to the Navy under the act of August 29, 1916, providing for its transfer in time of national emergency, and to provide a proper military status for the personnel of the Lighthouse Service subject to such transfer. More complete explanations of these and other recommendations are given later in this report.

SPECIAL LEGISLATION NEEDED.

INCREASE OF STATUTORY SALARIES.

The legislation most urgently needed for the Lighthouse Service at the present time is a revision of the salaries now fixed by statute, and other legislation for improving the status of the personnel, so as to permit the service to again attract, as it formerly did, a high grade of faithful and efficient employees. The small apparent increase in appropriations required to do this will in the end result in economy for the reason that in the carrying on of highly technical work such as that of the Lighthouse Service there is great waste through loss of time and ineffective work, when, as has become more and more the case in the last few years, the service does not offer sufficient inducements in the way of compensation to attract to it a personnel suited to its special needs, nor to retain many who do enter it. The proportion of trained and efficient personnel has diminished to a serious extent during recent years.

Congress has recognized the importance of the problem through the appointment of the Congressional Joint Commission on Reclassification of Salaries, which made a report on March 12, 1920. This report fully shows the need of readjustment of salaries and systematic grading of positions. There are at the present time very great and unjust inequalities in the scale of compensation, and certain portions of the personnel of the Lighthouse Service particularly suffer in this respect. Legislation is especially needed for the readjustment of statutory salaries in the Lighthouse Service and the Bureau of Lighthouses. The fact that Congress has both directly, and indirectly through lump-sum appropriations, provided in recent years much more liberal pay schedules for new organizations and has made substantial increases in pay for the military services and has extended these to several services with civil duties, but subject to transfer to the Navy in time of war as is the Lighthouse Service under the laws enacted, has greatly increased the difficulty of operating the Lighthouse Service with its inadequate and unadjusted salary scales. At present officers in the Lighthouse Service charged with important responsibilities are in some cases receiving less than half the compensation of persons in other services in similar status and with no greater responsibilities or requirements.

PROVISIONS FOR RETIREMENT FOR DISABILITY AND OTHER CHANGES
IN LIGHTHOUSE SERVICE RETIREMENT LAW.

For the persons in the Lighthouse Service covered by the act of June 20, 1918, it is very desirable that the retirement provisions be extended to cover cases, not due to vicious habits or misconduct, where an employee is found to be disabled for useful service before reaching the age fixed in the act. Because of the responsible and arduous character of much of the work, especially on vessels and at light stations, such provisions will add materially to the efficiency of the service, and relieve cases of serious hardship now arising. There is provision for retirement of persons incapacitated for duty in the Coast Guard and in the Army and Navy. In the general civil service retirement law of May 22, 1920, there is provision for retirement for disease or injury not due to vicious habits after 15 years' service. Persons coming under the act of June 20, 1918, are the only ones in the military or civil service of the Government to whom some such provision does not now apply, and legislation is needed to remedy this. Some other modifications in the retirement law are desirable in the interest of efficient organization.

EXTENSION OF MEDICAL RELIEF FOR LIGHT KEEPERS.

Light keepers are now entitled to medical relief at hospitals and stations of the Public Health Service. These hospitals are, however, inaccessible for a large number of light keepers who are stationed at remote or isolated points. Equal benefits should be extended to all light keepers, and legislation is needed to provide medical relief for all, and this has been concurred in by the Secretary of the Treasury.

OTHER MEASURES FOR RELIEF OF PERSONNEL.

Legislation is needed to permit the adjustment, within a moderate amount, of claims by lighthouse employees for loss or damage to personal property, such as clothing, furniture, etc., caused by storms, collisions, or fire at light stations, depots, and on vessels. Legislation is also needed to give corresponding employees of the Lighthouse Service certain necessary privileges now accorded by law to similar services, including the purchase of commissary supplies, transportation of families and of household effects when ordered to permanently change station, and transportation on Army transports.

INCREASE OF RATION ALLOWANCE OR OF COMPENSATION FOR LIGHT
KEEPERS.

The commutation of ration allowance authorized by the act of June 20, 1918, at 45 cents per day is insufficient to purchase food for one person for a day, and legislation is needed authorizing its increase to an amount reasonably sufficient for the purpose, or other provisions made for increase of compensation of light keepers. Although a number of the provisions recommended above would be of benefit to light keepers under certain conditions, and they have had some increase of base pay and bonus in recent years, the average pay

authorized by law of \$840 per annum, even with bonus, ration, and quarters when provided, is very small under present living conditions and is not commensurate with the service or qualifications required.

PROTECTION OF AIDS TO NAVIGATION.

Legislation is needed for the better protection of aids to navigation. Such aids, especially those located in the water, are often damaged by passing vessels, and it is difficult in many instances to locate the party at fault. More stringent requirements are necessary as to failure to report such injuries, etc. Sums received in payment should also be made available for repair of aids.

AIDS TO NAVIGATION.

During the fiscal year ended June 30, 1921, there was a net increase of only 31 in the total number of aids to navigation maintained by the Lighthouse Service, this being the smallest increase in a number of years, due to the large number of aids discontinued. There was a decrease of 49 lights and an increase of 47 gas buoys, 5 float lights, and 28 unlighted aids. On June 30, 1921, there were maintained by the Lighthouse Service 16,355 aids to navigation, including 5,756 lights of all classes and 593 fog signals (not including 152 buoys with whistles and 386 buoys with bells), of which 48 are submarine signals.

The table following gives a summary of the aids to navigation under each class established and discontinued during the fiscal year, and also the net increase and the number in commission at the end of the fiscal years 1920 and 1921:

Class.	1921			Total, June 30—	
	Estab- lished.	Discon- tinued.	Increase.	1920 ¹	1921
Lighted aids:					
Lights (other than minor lights).....	35	12	24	1,836	1,860
Minor lights.....	110	² 183	² 73	3,117	3,044
Light-vessel stations.....				49	49
Gas buoys.....	74	27	47	582	629
Float lights.....	10	5	5	169	174
Total.....	230	227	3	5,753	5,756
Unlighted aids:					
Fog signals.....	12	3	9	536	545
Submarine signals.....				48	48
Whistling buoys, unlighted.....	1	3	² 2	78	76
Bell buoys, unlighted.....	10	5	5	243	248
Other buoys.....	273	277	² 4	7,197	7,193
Day beacons.....	102	² 82	20	2,470	2,490
Total.....	398	370	28	10,572	10,600
Grand total.....	628	597	31	16,325	16,356

¹ Differences from statistics published in 1920 report are due to minor discrepancies in previous count.

² Includes 98 minor lights and 18 daymarks in Missouri River, which were discontinued in 1918.

³ Decrease.

Improvements in aids to navigation in the service generally have been made during the year, as follows: Thirty-five fixed lights were changed to flashing or occulting (including 3 light vessels), the illuminant of 2 lights was changed to incandescent oil vapor, the illuminant of 46 lights (including 2 light vessels and 8 lighted buoys) was changed to acetylene, the illuminant of 25 lights (including 1 light vessel) was changed to electric incandescent. As shown above, 597 aids to navigation of the various classes stated were discontinued during the year. The discontinuance of further aids is under investigation from time to time as the original necessity for their maintenance ceases, and in that event they are promptly put out of commission in the case of lights with the approval of the Secretary of Commerce.

Fog signals were established at nine important stations and the fog signals at three important stations were improved by the installation of more efficient apparatus. Work was continued during the year in repairing damage to aids to navigation caused by ice during the winter of 1917-18, especially to screw-pile structures in Chesapeake Bay and Potomac River. The work of repairing hurricane damage to aids in the Gulf of Mexico was also vigorously prosecuted during the year.

General repairs required for upkeep of aids to navigation in efficient working condition were continued during the year so far as available funds permitted, but the funds available were far from sufficient for the proper upkeep of this large amount of public property. Various special works were actively carried on during the year, including the establishment of important light and fog-signal stations, the construction of new light vessels and tenders, improvements in systems of fixed aids and buoyage, etc.

ALASKA.

During the year 22 new aids were established in Alaska. Eleven new lights were established; 3 lights were changed from fixed to flashing; 1 gas and whistling buoy, and 3 gas and bell buoys were established; also 6 unlighted buoys and 1 beacon.

The total number of aids to navigation in Alaska, including lights, gas buoys, fog signals, and daymarks, in commission at the close of the fiscal year ended June 30, 1921, was 548, including 206 lights and 13 gas buoys, representing an increase of 182 lighted aids since June 30, 1910, or 492 per cent. The following table, which gives the total number of aids to navigation on June 30 of 1910, 1915, and of each succeeding year, illustrates the progress in establishing aids in the Territory:

Aids.	1910	1915	1916	1917	1918	1919	1920	1921
Lights.....	37	112	147	152	161	180	196	206
Gas buoys.....				7	7	8	10	13
Fog signals.....	9	10	11	11	11	11	11	11
Buoys.....	84	167	181	189	198	211	224	225
Daymarks.....	30	49	49	56	61	64	94	93
Total.....	160	338	388	415	438	474	535	548

GUANTANAMO, SAMOA, AND GUAM.

The act of July 1, 1918, appropriated \$14,000 for dwelling for keepers of the lights and improving the lighting of the aids to navigation at Guantanamo Bay, Cuba. A double dwelling has been built at Windward Point Light Station, and the ranges at Fishermans Point and Hicacal Beach have been relocated, rebuilt, and the illuminant changed from oil to electricity.

The aids to navigation in the outlying United States territory at Guantanamo Bay, American Samoan Islands, and the island of Guam are maintained under the supervision of the naval commanders by means of allotments made from the appropriations for the Lighthouse Service. Reports have been received from naval officers in local charge indicating that the aids have been properly maintained at an approximate annual expense as follows: Guantanamo, \$4,570; Samoa, \$1,495; Guam, \$2,942.

VESSELS, URGENT NEED FOR REPLACEMENT.

The annual report for 1919 (and the report of the Secretary of Commerce for the same year, Appendix A) gave a full statement of the urgent need for the construction of additional vessels for the Lighthouse Service to replace those worn out in service, those lost through various casualties, and to meet the considerable growth of the service. The duty of the two types of vessels, tenders for buoy work and supply purposes, and light vessels for floating lighthouses was explained, as well as the severe usage and hazardous service to which these vessels are exposed. These conditions still continue.

The useful life of a lighthouse tender is about 25 years and of a light vessel about 30 years under normal conditions. The average age of the tenders is at present 21 years and of the light vessels 30 years. Of the light vessels now in use 23 are more than 30 years old and of the tenders 19 are more than 25 years old; 12 of the light vessels are over 50 years old. Since 1910, and particularly since the beginning of war conditions, there has been a considerable deficiency in the building of vessels sufficient to keep up this vessel equipment, aside from taking care of the large increase of about 40 per cent in the number of aids to navigation maintained. Some classes of the improved aids, particularly buoys and shore beacons, with automatic gas lights, have materially increased the work of the tenders.

A number of the older tenders are not designed to handle the modern types of heavy buoys, and some of them are not sufficiently seaworthy to be sent on outside work. Many of the lightships are not in condition to be safely placed on exposed stations. The cost of repairs and overhaul becomes so heavy that it is not economical to keep in commission vessels after they have reached a reasonable limit of usefulness. The effect of continuing the use of these old vessels is often a greatly diminished output of work with the same or greater cost of operation and upkeep. Of more importance than the question of efficient and economical operation, however, is that of safeguarding life. Both lighthouse tenders and lightships are engaged on hazardous duty, and their officers and crews should not be required to serve on vessels which have passed a reasonable limit of usefulness, nor can the Lighthouse Service properly perform

its part in the safeguarding of life and property on the navigable waters of this country without necessary vessel equipment.

The deficiency of vessels for the Lighthouse Service has been accentuated by a number of casualties in recent years, including losses by submarine, ice, fire, and collision, and also by the severe usage to which a number of tenders were put while cooperating with the Navy during the recent war. Since the statement in the report for 1919, it has also been necessary to put out of commission and sell three light vessels and one tender.

Very thorough investigation has been made as to the possibility of obtaining vessels suitable for work of the Lighthouse Service from the Shipping Board or from vessels no longer needed by the Navy on account of the cessation of the war. It was found that the Shipping Board had no vessels in any way suitable. From the Navy several small vessels have been transferred which will be used for shoal-water tender work, but they will be of but limited usefulness. Lighthouse tenders and light vessels are both vessels of unusual requirements, and it is impracticable to meet the special needs of this work by adapting vessels of other types. Investigation of the possibility of getting vessels from other departments is still continuing.

Congress, by the act of June 5, 1920, after full hearings authorized a building program for vessels for the Lighthouse Service of \$5,000,000 and an appropriation of \$1,000,000 of this amount was made in the act of March 4, 1921. Under this and previous appropriations the following vessels included in the list of 1919 are now under construction; on the last contract much lower bids were received than for a number of years, and this appears to be a favorable time for vessel construction.

Light vessels to replace *No. 71*, Diamond Shoal; *No. 51*, relief, third district; *No. 43*, relief, eighth district; *No. 20*, Cross Rip; *No. 3*, Handkerchief, Mass.; and for Barnegat, N. J.; tenders to replace *Jessamine*, fifth district, and *Gardenia*, third district; also the plans for the tender *Goldenrod* are in preparation.

From careful estimates and examinations as to the condition and further serviceability of vessels of the Lighthouse Service it is found that, in addition to those provided for by vessels now building, 16 light vessels and 11 tenders should be replaced within the next five years. As it will require from two to three years after appropriation is made before vessels are available for service, funds should be provided now for 15 of these vessels, being those more urgently needed, as shown in the following list:

ADDITIONAL VESSELS FOR WHICH APPROPRIATION IS NOW NECESSARY.

Tender to replace <i>John Rodgers</i> , third district, class B.....	\$310,000
Tender to replace <i>Holly</i> , fifth district, class B.....	310,000
Tender to replace <i>Mistletoe</i> , third district, class B.....	310,000
Two small tenders to replace <i>Myrtle</i> , third district, at \$100,000.....	200,000
Tender to replace <i>Arbutus</i> , fifth district, class B.....	310,000
Light vessel to replace <i>No. 55</i> , Lansing Shoal, Mich., class 3.....	150,000
Light vessel to replace <i>No. 5</i> , Stonehorse Shoal, Mass., class 2.....	310,000
Light vessel to replace <i>No. 4</i> , relief, second district, class 2.....	310,000
Light vessel to replace <i>No. 2</i> , relief, fifth district, class 2.....	310,000
Light vessel to replace <i>No. 46</i> , Tail of Horseshoe, Va., fifth district, class 2..	310,000
Light vessel to replace <i>No. 11</i> , Scotland, N. J., third district, class 2.....	310,000
Light vessel to replace <i>No. 57</i> , Grays Reef, Mich., twelfth district, class 3..	150,000
Light vessel to replace <i>No. 56</i> , North Manitou, Mich., twelfth district, class 3.	150,000
Light vessel to replace <i>No. 60</i> , Eleven Foot, Mich., twelfth district, class 3..	150,000

GENERAL TYPES OF VESSELS PROPOSED.

Vessels.	Length (feet).	Construction weight.		Esti- mated cost.
		Tons.	Cost per ton.	
LIGHT VESSELS.				
Class 1, most exposed stations.....	147	615	\$396	\$244,000
Class 2, exposed stations.....	135	530	396	210,000
Class 3, Great Lakes stations.....	96	240	621	150,000
TENDERS.				
Class A, seagoing.....	190	1,000	521	521,000
Class B, coastwise.....	170	595	521	310,000
Class special, inland rivers.....	150	250	500	125,000

ADMINISTRATION.

The general organization of the service remained unchanged during the fiscal year. The appropriations for the maintenance of the Lighthouse Service for the fiscal year 1922 are \$1,711,250 less than the estimates submitted and \$466,000 less than the total maintenance appropriations for the preceding fiscal year, 1921. Notwithstanding that there have been reductions in the costs of a number of supplies, and also in some wage scales affecting this service, it is doubtful whether the service can be adequately maintained during the year on the funds available without placing aids or vessels out of commission. The still continuing difficulties as to inadequacy and inequality of salary scales, particularly in some groups in the Lighthouse Service, have been stated in the preceding pages.

There has been a marked improvement in the matter of maintaining an adequate personnel on the vessels of the Lighthouse Service, due to the passing of war conditions. At the end of the year a system of longevity increase of pay, after six months' service for the unappointed members of the crews of Lighthouse Service vessels, was introduced for the first time, going into effect on July 1, 1921. It is believed this will have an important effect in maintaining a more efficient personnel on these vessels in the future. A system of longevity pay increase after five years' service was put into effect as respects the lighthouse keepers November 1, 1918, and has been of benefit. Systematic inspections have been continued in the various lighthouse districts of the technical work, business methods, and property accounts.

ENGINEERING AND CONSTRUCTION.

The more important items of construction completed during the fiscal year were the improvements at Woods Hole Lighthouse Depot, Massachusetts; Hunts Point Light and Fog-Signal Station, New York; restoring and improving the light station at Execution Rocks, N. Y.; the erection of a plate shop, iron shed, and coal pocket at General Lighthouse Depot, Tompkinsville, N. Y.; improving aids to navigation, East River, N. Y.; the establishment of an unattended light and fog signal at Bowlers Rock, Va.; the reestablishment of Choptank River Light Station, Maryland; the final completion of aids to navigation, Atchafalaya Entrance Channel, La.; the establishment of Point Borinquen Light Station, Porto Rico, on a new site; improvements to aids to navigation and new dwelling at Guantanamo Bay, Cuba; a new keepers' dwelling, Port San Juan, P. R.;

the establishment of a system of aids to navigation in Keweenaw Waterway, Mich.; and a system of aids to navigation in Fighting Island Channel, Mich.

Other important works in progress at the close of the fiscal year included the following: New lighthouse depot at Chelsea, Mass.; light keepers' dwellings at Brant Point and Wings Neck, Mass.; improving aids to navigation in Hudson River, N. Y.; a light and fog-signal station at Great Salt Pond, R. I.; improving the wharves and enlarging the machine shop at the General Lighthouse Depot, Tompkinsville, N. Y.; riprap protection for certain light stations in the third lighthouse district; repairing and rebuilding aids to navigation, Atlantic coast, damaged by storm and ice; aids to navigation, Eastern Shore of Chesapeake Bay, Md., and Va.; additional gas buoys, fifth lighthouse district; improving and establishing new aids, St. Johns River, Fla.; improving and establishing new aids on Florida Reefs, Fla.; a dwelling for Dry Tortugas Light Station, Florida; repairing and rebuilding aids to navigation, seventh and eighth lighthouse districts; improvement of aids on Mississippi River below New Orleans; new fog signal for Galveston Jetty Light Station, Texas; a dwelling for South Pass Range Rear Light Station, Louisiana; repairing and rebuilding aids to navigation, Gulf of Mexico, damaged by hurricanes; a new light station at Sabine Pass Jetty, Louisiana; riprap protection at Sand Island, Ala.; new dwelling and tower, Point Jiguero, P. R.; improvements to aids to navigation at Conneaut Harbor and Fairport Harbor, Ohio; establishing aids to navigation in Detroit River, Mich.; repairs to pier at Spectacle Reef Light Station, Michigan; improving aids in St. Marys River, Mich.; improvement at Detroit, Mich., Lighthouse Depot; improvements to aids to navigation at Indiana Harbor, Ind., and Chicago Harbor, Ill.; a dwelling at Poverty Island, Mich.; Lighthouse Depot, sixteenth lighthouse district; aids to navigation, Alaska; aids to navigation, Coquille River, Oreg., and in Washington and Oregon; keepers' dwelling at Yaquina Head, Oreg.; light station at Point Vicente, Calif.; and a keeper's dwelling at Diamond Head, Hawaii. These works are described on pages 45 to 53.

IMPROVEMENTS OF APPARATUS AND EQUIPMENT.

During the year experiments and tests for the purpose of determining the efficiency of radio fog signals automatically sent out from light stations and light vessels and received by a radio compass installed on a vessel in order to determine its position or to run a course in foggy weather, as mentioned in the last annual report, were actively pushed forward in cooperation with the Bureau of Standards. These installations are more fully described on page 24.

Radio equipment was installed on three light vessels and on one tender during the fiscal year. At the end of the year 45 light vessels and 28 tenders in all had been equipped with radio apparatus. Improvements of intercoastal communication by the installation of telephones at light stations were continued during the year by the Coast Guard. On June 30, 1921, 280 light stations had telephone connections.

The automatic aerial fog bell, having a striking mechanism operated by compressed carbon dioxide, has been continued in service during the fiscal year on a buoy in the fifth lighthouse district, replacing the former Bush Bluff Light Vessel, and at Cherrystone Bar

Light Station, Virginia. It was sufficiently successful at these two points to warrant its installation at Bowlers Rock, Rappahannock River, Va., when the light was reestablished December 10, 1920.

Arrangements have been made with the Navy Department for the installation of radio telephones at Scotch Cap and Cape Sarichef Light Stations, southwestern Alaska, which will be installed this present summer. Owing to the isolation of these stations communication with them by radio should prove very valuable. The eleventh lighthouse district is also taking measures for wireless telephone apparatus at isolated stations.

The new tall type metal cone buoys, referred to in the last annual report, as designed to replace wooden buoys used in shoal water channels has proved so efficient that 50 of the third class have been placed in service in the third lighthouse district. Three second class buoys of this type are now being built for test.

In connection with the installation of a proposed acetylene light at Lehua Island, Hawaii, where the ascent to the summit is exceedingly difficult, it was found practicable and safe, with high-pressure special piping, to pipe the gas at high pressure to any distance.

On October 20, 1920, the superintendent of the fifth lighthouse district inspected the aids in New River Inlet and Bogue Sound, N. C., by hydroplane in two hours, which would have required at least four days by other means of travel, owing to the inaccessibility of the aids inspected.

A mechanism, to be used in connection with a fog-bell striker, has been made and put into service which permits of a long running time on one winding, avoiding the use of tall and unsightly towers formerly employed to secure the necessary drop or fall of the driving weights.

With the growth of commercial and other electric generating plants and the extension of reliable electric current to the neighborhood of light stations, there has been an increasing use of electricity during the year for lamps in lenses and for fog-signal purposes. The use of electric welding outfits at depots in building up worn-out appendages for buoys and general repair work, in repairing broken tension members of skeleton towers and to a limited extent in boiler repairs is also on the increase.

On several occasions it has been found desirable to establish a bell buoy at a location near enough to an existing bell buoy but which may cause a confusion of sounds. To avoid this danger a design for a gong buoy is under way, which will work on the same principle as a bell buoy, but will give an entirely different sound.

A set of pile-driver leads used in connection with a tender's boom and hoisting gear has been employed with success in driving piles in construction work, avoiding the use of a floating pile driver and the necessity for towing one about the district.

Experiments and tests were continued during the year with various devices and equipment used in lighthouse work, resulting in improvements and investigations which may ultimately be of service in the interest of efficiency and economy. Among these are the following: A simple form of vaporizer for second district lamp; a new type of 375 mm. acetylene buoy lantern with pressed lens is being built; a fog-signal testing station has been completed at Execution Rocks, N. Y., and experiments will be carried out; mantles of artificial silk are now undergoing test and have so far shown considerable improve-

ment over the old type; district homemade buoy shackles are showing a lower cost than those purchased under contract; improvements in the supply and storage of cheaper grades of kerosene at fog-signal stations are being made. The practicability of using radium paint for marking aids in locations where vessels pass closely but where traffic does not warrant the use of lighted aids is being tried out; the use of a hygroscope controlling device for fog signals is being investigated; a binaural apparatus for determining the direction of aerial sound in foggy weather will be tested. The use of oil burners for tenders' galley ranges is increasing. Remote control of fog signals by radio apparatus is under consideration and a system of concrete jacketing old wooden piles supporting lighthouse structures, against attacks of teredo, has been applied in the eighteenth district.

PERSONNEL.

On June 30, 1921, there were 5,922 persons employed in the Lighthouse Service, including 93 technical, 155 clerical, and 5,674 employees connected with light stations, vessels, and depots. This is a net reduction of 80 during the fiscal year. This service is charged with the maintenance of aids to navigation along 49,012 statute miles of general coast line and river channel.

The following table gives the number of employees (all authorized employees, including some vacancies) of the Lighthouse Service at the end of the fiscal year and a comparison of the totals with those for the previous fiscal year:

EMPLOYEES IN THE LIGHTHOUSE SERVICE ON JUNE 30, 1921.

District.	Bureau officers, engineers and draftsmen, district superintendents, draftsmen, and technical assistants.	Clerks, messengers, janitors, and office laborers.	Depot keepers and assistants, including laborers.	Light keepers and assistants.	Laborers and laborers in charge of lights (appropriation "Salaries, keepers of lighthouses").	Laborers in charge of post lights and buoys (appropriation "General expenses").	Custodians of reservations.	Officers and crews on tenders and light vessels.	Field force for construction and repair (registered).	Field force for construction and repair (unregistered).	Total.
Bureau	14	26									40
First	12	6	1	115	3			74	11	9	221
Second	12	4	2	50	11		2	239	8	11	363
Third	14	32	10	185	30	43	2	1,300	183	45	844
Fourth	1	5	3	52	3	4	9	33	8	11	132
Fifth	1	10	14	166	96	20		291	14	3	651
Sixth	4	7	2	55	10	25		143	15		261
Seventh	3	4	2	41	1	8		39	5	17	120
Eighth	5	9	15	113	35	41		115	13	17	363
Ninth	2	5	3	40	9			25	5	6	95
Tenth	2	5	2	69	1		1	28	12	13	136
Eleventh	5	6	6	157	8	2	1	109	17	29	340
Twelfth	5	6	6	156	17	2		108	7	13	320
Thirteenth	1	2				220		19			242
Fourteenth	1	2				541		14			558
Fifteenth	1	2				331		21			355
Sixteenth	4	5	1	34		28		54	2	13	141
Seventeenth	3	6	5	79	16	124		131	10	31	394
Eighteenth	4	6	7	106	13	6		96	5	22	265
Nineteenth	3	3	1	26	2			31	1	10	77
All force	1										4
Total, 1921	94	154	110	1,471	255	1,395	15	1,870	316	239	5,922
Total, 1920	124	158	103	1,471	254	1,504	15	1,862	293	218	6,002
Increase			7	3	1			8	23	21	
Decrease	30	4				109					80

¹ Includes 7 appointed employees.

Of the positions in the above table 56 are statutory and 5,866 are paid from lump-sum appropriations. Of the latter, however, the average pay of the light keepers (1,474) is fixed by law at \$840.

The annual report of the United States Employees' Compensation Commission, for the fiscal year ended June 30, 1920, gives the number of reported cases of injury subject to compensation, for the calendar year 1919, of employees of the Lighthouse Service, sustained while in the performance of duty, and resulting in death and disability, as follows: Cases resulting in death, 5; cases resulting in permanent total or partial disability, 8; and of temporary total disability, 78. This number is nearly double that for all other branches of the department combined, for the period stated, and indicates the hazardous nature of the field work of the Lighthouse Service. It is believed that the authorized maximum compensation for disability on account of injury is too low to meet the present cost of living, and that congressional action is desirable to provide a more adequate scale of compensation for employees who have lost their earning power because of disability through injury sustained while in the performance of duty.

COST-KEEPING SYSTEM AND RESULTS.

A cost-keeping system has been continued in effect throughout the fiscal year. The costs are based on the actual expenditures during the fiscal year, whether of money or supplies. The information from this cost-keeping system is useful in furnishing information as to the disposition of all appropriations for this service, in preparing estimates, planning work, effecting economies, and comparing the efficiency of different districts, vessels, light stations, apparatus, methods, etc.

A generalized summary of costs for the fiscal year ended June 30, 1921, follows, as derived from this cost-keeping system.

SUMMARY OF COSTS, LIGHTHOUSE SERVICE, FISCAL YEAR ENDED JUNE 30, 1921.

[Amounts are stated to nearest even dollar, causing occasional minor discrepancies in totals. Difference from total expenditures reported elsewhere is due to inclusion of Bureau salaries, printing expenses, and adjustment of inventories of articles furnished from stock.]

TOTAL COSTS OF PRINCIPAL FEATURES.

Feature.	Maintenance expenses.				Betterment expenses.			Grand total.	Per cent.
	Salaries.	Subsistence.	General supplies.	Incidental expenses.	Total.	Repairs and improvements.		New works.	Total.
						Hired labor.	Materials.	Contract work.	
Administration ¹	\$433,025	\$32,417	\$39,127	\$9,300	\$513,869				\$513,869
Distributive charges ²	1,827,483	371,577	1,043,082	51,175	3,293,297				4,291,364
Aids to navigation ³	2,721,058	395,085	1,015,634	14,314	4,137,091	\$105,033	\$103,948	\$289,727	5,502,676
						251,730	298,671	140,943	1,365,585
Total.....	4,981,566	790,079	2,097,823	74,789	7,944,257	356,763	392,619	430,670	10,307,909
								1,183,600	2,363,652
									10,307,909

TOTAL COSTS OF DETAILED FEATURES.

Offices.....	\$433,025	\$32,417	\$57,131	\$9,300	\$531,873				\$531,873	5.1
Depots.....	295,952		198,182	23,206	518,290	\$14,619	\$44,835	\$7,339	741,921	7.2
Tenders:										
Large.....	420,383	103,367	279,305	6,091	809,146	15,066	20,686	42,975	882,899	8.7
Medium.....	978,275	237,950	494,578	18,126	1,728,929	39,366	30,700	214,165	2,023,211	19.6
Small.....	131,873	30,260	53,043	3,752	218,928	5,982	7,727	25,248	396,401	6
Total.....	1,530,531	371,577	826,926	27,969	2,757,003	60,414	59,113	282,388	3,531,439	34.3
Light vessels:										
Exposed.....	342,460	63,807	113,190	1,439	520,890	12,864	16,737	39,249	711,097	6.9
Moderately exposed.....	214,908	39,679	40,048	146	294,781	5,009	17,390	27,545	341,725	3.3
Relief.....	113,188	22,452	38,966	266	174,872	6,319	10,310	17,180	208,681	2
Lakes.....	88,593	21,266	24,046	992	134,897	3,013	2,554	3,099	211,672	2.1
Total.....	759,149	147,198	216,250	2,843	1,125,440	27,205	46,991	87,073	1,476,175	14.3

Light stations: Primary seacoast and lake lights..... All other lights (except post lights)..... Post lights..... Day marks and spindles.....	459,402	73,353	142,949	4,546	680,250	38,470	38,678	16,705	82,811	176,664	856,914	8.3
	1,185,473	105,435	315,379	5,913	1,672,200	140,712	158,896	28,727	304,427	632,762	2,304,962	22.4
	262,591	99	47,937	937	311,564	6,041	15,040	2,877	.....	23,958	335,522	3.3
	350	.....	435	75	860	3,493	5,632	442	500	10,067	10,927	0.1
	1,907,816	238,887	506,700	11,471	2,664,874	188,716	218,246	48,751	387,738	843,451	3,508,325	34.1
Buoys.....	54,083	.....	292,684	.....	346,777	35,809	23,434	5,119	107,037	171,399	518,176	5
Grand total.....	4,981,566	780,079	2,097,823	74,789	7,944,257	356,763	392,619	430,670	1,183,600	2,363,652	10,307,909	100

AVERAGE COST OF SELECTED FEATURES.

	Average cost of—				Salaries.	Subsistence.	General supplies.	Incidental expenses.	Total maintenance.	Repairs and improvements.	Total cost.
District office, exclusive of third	16,524	464	491	422	17,901	.....	17,901
District depot, exclusive of general depot.....	4,647	.....	1,380	312	6,339	1,943	8,282
Large tender, Pacific.....	42,252	10,757	20,842	482	83,332	6,617	89,950
Large tender, Atlantic.....	41,896	10,056	26,656	694	79,302	8,710	88,012
Medium tender.....	30,859	7,418	16,293	479	54,050	9,341	63,391
Exposed light vessel.....	17,123	3,190	5,060	72	26,045	3,442	29,487
Moderately exposed light vessel.....	11,311	2,088	2,107	8	15,515	2,628	18,143
Lake light vessel.....	7,278	1,608	1,636	42	10,584	532	11,066
Primary seacoast light station.....	3,104	499	962	31	4,596	634	5,230
Other light station (except post lights).....	537	75	143	2	757	149	906
Post light, river district.....	101	.....	11	.....	112	3	115
Post light, other district.....	99	.....	32	1	132	22	154

¹ Includes offices, except expenses of publications.
² Includes depots and tenders; also item excepted above, charged to supplies.
³ Includes light vessels, light stations, minor fixed aids, and buoys.

NOTE.—In the cost-keeping summaries for previous years the amounts paid from the appropriation, "Increase of compensation," were not included for the third lighthouse district, the total amount omitted for each year being as follows: 1918, \$40,196; 1919, \$57,039; 1920, \$116,609. These omissions affect the figures reported for salaries.

APPROPRIATIONS AND EXPENDITURES.

The appropriations for the maintenance of the Lighthouse Service for the fiscal year 1922 were \$7,843,290, being \$466,000 less than those for the preceding fiscal year. These appropriations were \$1,711,250 less than the estimates submitted. An appropriation for special work of \$7,000 was made in a deficiency appropriation bill during the fiscal year 1921, and appropriations for special works aggregating \$1,006,500 were made in connection with the general maintenance appropriations for the fiscal year 1922 in the sundry civil bill of March 4, 1921. The average appropriations for special works for the 10 preceding years, 1912 to 1921, inclusive, amounted to \$779,035.

The detailed estimates for the fiscal year 1923 are given on pages 69 to 82. The total amount for general maintenance is \$281,510 more than the appropriation for the present year, but is \$177,290 less than the appropriations for the fiscal year 1921. Particular attention is again invited to the urgent need of the Lighthouse Service for additional funds. The cost of materials, though reduced to some extent, has not declined sufficiently to permit a material reduction in funds needed for the support of the Service, especially in view of the large amount of upkeep work which is becoming increasingly urgent because of inadequate funds available during the past few years, and in order that the Service may be maintained at a proper standard of efficiency an adequate appropriation is necessary.

Increases are urgently needed in the pay scale of the Bureau of Lighthouses in Washington, and it is recommended that this general subject be considered and favorably acted on by Congress, in accordance with the report submitted by the Joint Commission on the Reclassification of Salaries.

Estimates for 30 special works have been submitted, aggregating \$3,967,050, considering only group 1, of which items amounting to \$2,808,500 have been authorized by law. As no appropriation was made for special works for 1921, this estimate includes a number of important works for which estimates were submitted last year, but which were not appropriated for. The estimates include 3 new lighthouse tenders, one a patrol boat, 4 new light vessels, 6 new lighthouse depots, or the completion of new depots, 6 items for establishing or improving aids in general localities, 7 items for improvements of harbor or channel lights and other aids, 3 items for establishing or completing light and fog-signal stations, and 6 items for improvement of lighthouse depots.

In selecting and submitting estimates for these special works, believed to be most important, there were considered estimates submitted by officers in the various districts and others for new lighthouse and ship construction aggregating about \$9,250,000, which amount, however, did not include most of the urgently needed vessel rebuilding program. Many items not included in the estimates for this year are thought to be meritorious, and the more important of them are included in group 2 of the estimates for special works, submitted for consideration as the resources of the Government permit them to be taken up. Explanation of the necessity for each of the items of special works is included with the estimates.

The tables following give comparisons of appropriations and expenditures for the Lighthouse Service, beginning with the fiscal year 1918 and including the estimates for 1923:

APPROPRIATIONS, LIGHTHOUSE SERVICE, FISCAL YEARS 1918-1922, WITH ESTIMATES FOR 1923.

[The salaries and allowances of officers of the Army on duty with the Lighthouse Service are not included in this table.]

Item.	Appropriations.					Estimates.
	1918	1919	1920	1921	1922	1923
MAINTENANCE.						
Salaries, Bureau of Lighthouses.....	\$64,030	\$65,430	\$65,430	\$68,290	\$68,290	\$92,000
General expenses, Lighthouse Service.....	2,850,000	3,500,000	4,000,000	4,000,000	4,200,000	4,400,000
Salaries of keepers of lighthouses.....	940,000	1,194,432	1,300,000	1,300,000	1,300,000	1,300,000
Salaries, lighthouse vessels.....	1,104,650	1,265,000	1,775,000	1,870,000	1,800,000	1,800,000
Salaries, Lighthouse Service.....	380,000	380,000	383,000	400,000	400,000	460,000
Retired pay, Lighthouse Service.....		30,000	65,000	71,000	75,000	80,000
Total for maintenance.....	5,338,680	6,434,862	7,588,430	8,309,290	7,843,290	8,132,000
Unexpended balances (obligations estimated).....	14,100	66,283	35,775	24,357		
SPECIAL WORK.						
New light and fog-signal stations.....	155,000	80,000	26,000			333,000
Light vessels.....	280,000		450,000		1,000,000	880,000
Lighthouse tenders.....	210,000		760,000			620,000
Keepers' dwellings.....			50,000			16,500
Improvement of aids.....	613,000	795,000	393,000		13,500	884,000
Lighthouse depots.....	21,000	288,000	42,000			1,233,550
Total for special works.....	1,279,300	1,163,000	1,721,000		1,013,500	3,967,050
Total maintenance and special works.....	6,617,980	7,597,862	9,309,430	7,837,290	8,856,790	12,099,050

EXPENDITURES FROM APPROPRIATIONS, LIGHTHOUSE SERVICE, FISCAL YEARS 1917-1921.

[Actual expenditures, regardless of year of appropriation.]

Expenditures.	1917	1918	1919	1920	1921
For maintenance.....	\$5,220,473.07	\$6,246,088.83	\$6,694,537.90	\$8,583,292.14	\$9,594,466.98
For special works.....	651,298.99	499,633.24	880,958.40	1,006,501.26	1,185,355.26
Total.....	5,871,772.06	6,745,722.07	7,575,496.30	9,589,793.40	10,779,822.24

During the fiscal year 1921 employees of the Lighthouse Service were paid a total of \$884,785 (included in above total of expenditures, but not in appropriations) from the appropriation increase of compensation, Department of Commerce, in addition to salaries paid from Lighthouse appropriations.

Benefits not included in the above statement were received by the Lighthouse Service from the following sources:

Medical treatment by the Public Health Service, without charge, was received by approximately 887 employees of the Lighthouse Service during the fiscal year for an aggregate of approximately 5,776 days.

Compensation for injuries under the employees' compensation law was received by some employees of the Lighthouse Service.

NOTE.—The amount received by employees of the Lighthouse Service as increase of compensation during the fiscal year 1918, not heretofore reported, was \$260,034. In the statements in the annual report, 1919, page 24, and 1920, page 19, the amounts reported as paid for increase of compensation are included in the total of expenditures in the preceding statements, but not in the statement of appropriations. See also note following "Summary of costs," page 17.

LIGHTHOUSE DEPOTS.

A lighthouse depot, very much needed for the Alaska district, has been partially built at Ketchikan, Alaska, under appropriations of \$90,000 and \$12,000. While the wharf and storehouse have been put in use during the fiscal year, the funds are not sufficient to complete the depot.

Work on the construction of a new lighthouse depot at Chelsea, Mass., for the second lighthouse district, under an appropriation of \$85,000 made by act of July 1, 1918, was in progress at the end of the fiscal year, but the amount will be insufficient to complete the depot.

Under the allotment of \$175,000 in August, 1916, from funds for national security and defense, a new plate and boiler shop, a new shed for the storage of iron bars and shapes, and a new coal pocket have been completed.

The act of June 20, 1918, authorized \$275,000 for improvements at the lighthouse depot at Portsmouth, Va., or establishing a new depot, but no appropriation has been made for this work. This is the principal depot of one of the largest lighthouse districts and is the headquarters for five tenders and two light vessels during the greater part of the year. The facilities for berthing these vessels are entirely inadequate, and the efficient operation of the vessels is much hampered in consequence. The inadequacy of space for storing and handling buoys also causes much delay and loss. Increased facilities for this depot are urgently necessary.

The act of June 5, 1920, authorized \$60,000 for completing the lighthouse depot at Charleston, S. C., \$250,000 for a new depot at Key West, Fla., \$16,500 for two keepers' dwellings at Goat Island Lighthouse Depot, Calif., and \$120,000 for a new depot at Honolulu, Hawaii, but no appropriation has been made for these works.

LIGHTHOUSE TENDERS.

The tenders of the service have been in operation throughout the year, except one which was laid up a part of the year because of lack of funds. There are 55 tenders which have been in commission and collectively they have steamed a total of about 465,000 nautical miles in their work of maintaining buoyage, carrying supplies and construction materials to stations supplying light vessels with coal, water, etc., also transporting officers and employees to stations or on inspection duty; also duty in cooperating with other Government services and saving of life and property when the occasion required. Several of the older tenders have reached the point where, because of age and deterioration, their usefulness and seaworthiness are impaired and they are greatly in need of replacement, being beyond economical repair. It will be necessary to construct at least two tenders each year to maintain the fleet in an efficient condition.

A more detailed statement of the needs of vessels is given on pages 9 to 11.

An appropriation of \$20,000 was made July 1, 1916, for a light draft tender and barge for use along the intercoastal waterways of Texas and Louisiana. Proposals were invited four times and a contract was finally awarded for the construction of a small tender, the *Aster*, which is now being built.

The act of June 12, 1917, appropriated \$150,000 for a tender for the third district, or elsewhere. It is proposed to use this appropriation for the construction of a tender for the fourteenth district to replace the tender *Goldenrod*, which is nearly worn out. Plans and specifications are now being prepared for this vessel.

The act of November 4, 1919, appropriated \$760,000 for the construction of tenders and light vessels. Plans and specifications were prepared, but on receipt of bids it was found that only two vessels could be built with the amount appropriated, and contracts were accordingly awarded for two tenders, the *Oak* and *Hawthorn*, which are most urgently needed to replace the tenders *Gardenia* and *Jessamine*. The new tenders are under construction and are nearly completed.

The act of June 5, 1920, authorized \$5,000,000 for—

Constructing or purchasing and equipping lighthouse tenders and light vessels. provided that the Secretary of War, the Secretary of Navy, and the Shipping Board shall report to the Secretary of Commerce such vessels as they are willing to dispose of and which by reasonable alterations can be used for light vessels, or lighthouse tenders; and if the use of the vessels should be justified by the necessary expenditure for alterations, transfer of the ships shall be made to the Department of Commerce, and they shall be used for the purposes of this act; and the sum herein authorized shall be available for such repairs and be reduced by the sums saved by the use of such vessels.

In anticipation that an appropriation would be made by Congress specific data covering the type of vessels required by this service to meet its needs, were submitted to the War and Navy Departments and the Shipping Board for the purpose of ascertaining if any suitable vessels are available for transfer. It was found that no vessels of the type required for lighthouse purposes were obtainable. This matter is, however, still under investigation.

Much difficulty has been experienced in making repairs to vessels, due to inadequate funds and the high prices of labor at the various repair yards.

The following tenders either have been extensively overhauled or such work has been started during the fiscal year 1921: *Shrub*, *Iris*, *Columbine*, *Arbutus*, *Holly*, *Maple*, *Cypress*, and *Mangrove*.

It is probable that during the current year extensive overhaul will be completed or undertaken on the following tenders: *Anemone*, *Mayflower*, *Madrono*, *Snowdrop*, *Aspen*, *Camellia*, *Daisy*, *Ivy*, *Larkspur*, *Manzanita*, and *Myrtle*.

The following was the number of tenders of the Lighthouse Service on June 30 of the years specified, omitting vessels not having regular crews and those less than 50 feet in length: 1910, 51; 1915, 46; 1916, 47; 1917, 51; 1918, 51; 1919, 55; 1920, 55; 1921, 55.

On June 30, 1921, the following was the status of the tenders: In actual service, 49; undergoing repairs, 5; laid up, 1.

LIGHT VESSELS.

The Lighthouse Service maintains light vessels on 49 stations and has for this purpose 64 light vessels, of which 15 are relief vessels. Some of these vessels are old, 3 having been built over 50 years ago, 8 having been built over 60 years ago, 1 is 72 years old. Some of the older vessels are in a condition which does not warrant extensive repairs.

The act of November 4, 1919, appropriated \$450,000 for the construction of a light vessel for Diamond Shoal Light Vessel Station, North Carolina, to replace light vessel *No. 71* which was sunk by a German submarine on August 6, 1918. The station is at present marked by light vessel *No. 72*, which was a relief vessel. The new light vessel, *No. 105*, now under construction, will be placed on this station when completed.

The act of June 12, 1917, appropriated \$130,000 for a light vessel for Cape Charles, Va., or for general service, plans and specifications were completed, and bids invited for the construction of the vessel. The lowest bid received was greatly in excess of the appropriation. No expenditures were made from this appropriation to June 20, 1920. It is proposed to construct a smaller light vessel for general service with this appropriation when shipbuilding costs become more normal.

The act of March 4, 1921, appropriated \$1,000,000 for lighthouse vessels for general service. Plans and specifications were prepared, bids invited for three, four, or five light vessels of class 2 type, and a contract was made July 8, 1921, for five light vessels at an average contract price of \$184,000. These vessels are now under construction.

Two light vessels were condemned during the fiscal year as follows: Light vessel *No. 61*, Lake Huron, Mich., was withdrawn from station in the early fall of 1920, being considered unsafe to retain on station during the stormy season. After advertisement the vessel was sold August 8, 1921, for \$145. Light vessel *No. 62*, formerly stationed at Bar Point Shoal, Detroit River, was permanently withdrawn after the close of navigation in 1919, the Canadian Government having agreed to establish a light vessel on the station, which is located in Canadian waters. The vessel being beyond economical repair was sold August 8, 1921, to the highest bidder for \$200. The nominal amounts received for these vessels indicate their extremely poor and worn-out condition.

The installation of radio on light vessels is in progress. At the end of the fiscal year, 45 light vessels were equipped with radio apparatus. Three vessels were equipped during the fiscal year 1921. This work has been done by the Navy Department in cooperation with the Lighthouse Service and was paid for with funds from naval appropriations.

During the fiscal year 60 light vessels were in commission. New vessels, *No. 99* and *No. 103*, were completed and assigned to the eleventh and twelfth districts, respectively, on the Great Lakes.

The following light vessels have either been extensively overhauled or such work has been started during the last fiscal year: *No. 41*, *No. 47*, *No. 52*, *No. 53*, *No. 72*, *No. 78*, *No. 79*, *No. 81*, *No. 83*, and *No. 102*. It is probable that during the current fiscal year extensive overhaul will be completed or undertaken on the following light vessels: *No. 5*, *No. 39*, *No. 46*, *No. 52*, *No. 66*, *No. 69*, *No. 79*, *No. 83*, and *No. 84*.

The following was the total number of light vessels and stations on June 30 of the years named:

Year.	Light vessels.	Light- vessel stations.	Year.	Light vessels.	Light- vessel stations.
1910.....	68	54	1918.....	67	52
1915.....	66	53	1919.....	65	50
1916.....	66	53	1920.....	62	49
1917.....	68	53	1921.....	64	49

Of the present light vessels, 38 have self-propelling machinery and 25 are provided with sail power only. One has no means of propulsion.

On June 30, 1921, the following was the status of the light vessels: Regular vessels on station, 42; relief vessels on station, 7; relief vessels at depots, 4; regular vessels under repair, 7; relief vessels under repair, 2; regular vessels laid up, 1; relief vessels laid up, 1.

REPORT OF OPEN-MARKET PURCHASES.

In compliance with the act of June 17, 1910, there is submitted separately as a part of this report a list of purchases of materials and supplies for the Lighthouse Service made without obtaining bids under public advertisement, with the reasons for so purchasing.

LEGISLATION ENACTED AFFECTING THE LIGHTHOUSE SERVICE.

The sundry civil appropriation act for the fiscal year 1922, approved March 4, 1921, contained an amendment to the Lighthouse Service retirement law of June 20, 1918, providing for retention in the service for periods of two years, not exceeding a total of four years, upon the certification of the Secretary of Commerce, of employees covered by that law who have reached the age for compulsory retirement, 70 years.

The appropriations for the maintenance of the Lighthouse Service for the fiscal year 1921 are shown in tables on page 64. No additional special works were authorized by Congress during the fiscal year. The statistics as to the various classes of aids to navigation and fuller details on many of the subjects mentioned in this report will be found in the pages following.

Respectfully,

GEORGE R. PUTNAM,
Commissioner of Lighthouses.

To Hon. HERBERT HOOVER,
Secretary of Commerce.

RADIO FOG SIGNALS AND THEIR USE IN NAVIGATION IN CONNECTION WITH THE RADIO COMPASS.

Three radio fog-signal stations in the vicinity of New York were placed in commission by the Lighthouse Service on May 1, 1921, these being the first service installations of this kind in the United States. The following account gives a general description of these signals and their purpose and development.

SYSTEM OF NAVIGATION BY RADIO DIRECTION SIGNALS.

This system is based on the equipment of selected important lighthouses and light vessels along the coast with apparatus for sending radio signals of simple and definite characteristics during the continuation of fog or thick weather, by means of which the navigator of any vessel provided with a radio compass may take definite bearings to guide or to locate his ship, although no object is visible. The most valuable use of the radio fog-signal will probably be as a leading mark, as, for example, to enable a vessel to make a lightship anchored in the approach to a harbor or to pass outside of a lightship anchored to guard against dangers off the coast. The navigator will also be able, as in navigation using visible objects, to locate his ship by cross bearings on two or more radio stations or by repeated bearings on the same station with the distance logged between bearings, or by a single bearing and dead reckoning, etc. This system, for the first time in navigation, affords a practicable means by which the navigator can take reasonably accurate bearings on fixed beacons which are not visible. Its prospective importance is due to the fact that one of the greatest needs for increasing safety of navigation is improved means to enable a mariner to guide and to locate his vessel in thick weather when he can see no lights or landmarks.

Another very important use will be to enable vessels to locate each other when meeting, approaching, or needing assistance in fog. Two striking illustrations of the importance of radio bearings in rescue work at sea have recently been reported. The Norwegian steamer *Onataneda* was in distress off Newfoundland and gave her position by dead reckoning 90 miles in error. The only ship able to discover her correct position was the steamship *Fanad Head*, equipped with a radio direction finder, which was thereby enabled to save the lives of those on board the *Onataneda*. The steamer *Wahkeena* was within 14 miles of the steamer *Alaska*, recently lost off Cape Mendocino, Calif., when she picked up the radio distress signals of the *Alaska*, but it was 10 hours before the *Wahkeena* reached the scene of the wreck, having no means of determining the direction of the signals; many lives might have been saved, first, had there been a radio fog signal on Blunts Reef Light Vessel and radio compass on the *Alaska*, and, second, had there been a radio compass on the *Wahkeena*.

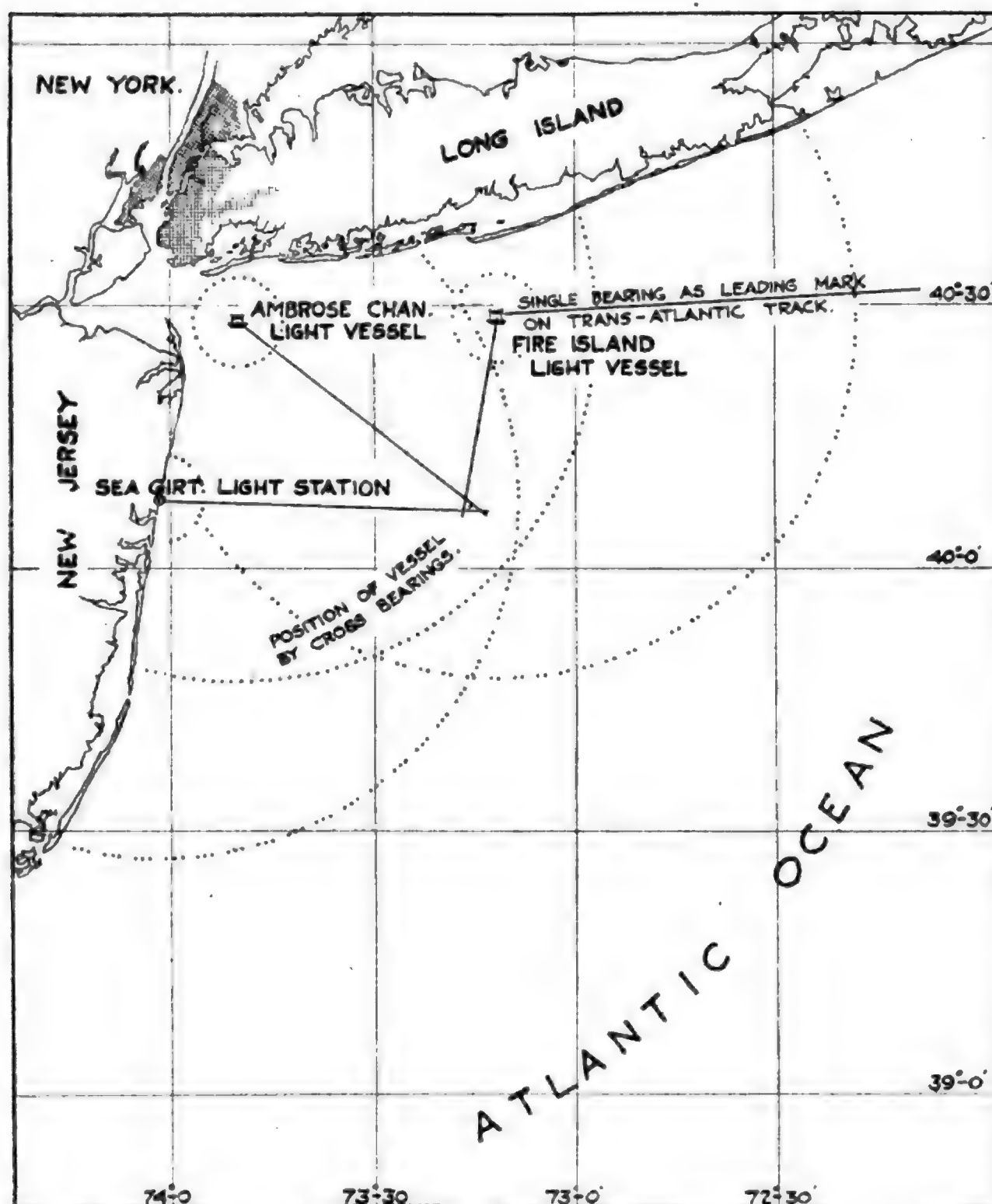


Chart showing location of three radio fog signal stations in the vicinity of New York, with example illustrating the use of radio signal as leading mark for which a vessel may steer in approaching New York; also example of the obtaining of the position of a vessel by cross bearings on three radio stations. The distinctive characteristics of the signals from these three stations are indicated by dots on the circles; the larger circles are at the approximate useful limits of these signals.

SENDING STATIONS ESTABLISHED AND THEIR CHARACTERISTICS.

The three stations for sending radio fog signals now in commission are Ambrose Channel Light Vessel, Fire Island Light Vessel, and Sea Girt (N. J.) Light Station. These stations were selected so as to enable vessels approaching or leaving New York to locate themselves conveniently by cross bearings and to furnish convenient leading marks to approach the harbor. The stations are identified by the characteristics of the signals, thus Ambrose Channel sends one dash, Fire Island a group of two dashes, and Sea Girt a group of three dashes, with brief intervals between the groups. The particular station on which a radio bearing is being taken in a fog is by this means just as definitely known as is the light on which a sight bearing is taken by the navigator of a ship identified by its order of flashes or color. The signals are operated continuously during thick or foggy weather, and also at the present time they are sent each day from 9 to 9.30 a. m., and from 3 to 3.30 p. m., so as to permit any vessel equipped with radio compass to try out the method and apparatus in clear weather. To avoid continuous interference between the signals themselves they are sent on different time schedules as follows: Ambrose sends for 20 seconds, silent 20 seconds; Fire Island sends for 25 seconds, silent 25 seconds; Sea Girt sends for 60 seconds, silent 6 minutes. The signals are repeated rapidly, Sea Girt, for example, sending over 40 groups of dashes a minute.

The transmitting apparatus now in use is a commercial panel type transmitting set of simple and rugged construction of about 1 kilowatt power. In addition to this set, a special automatic motor-driven timing switch for producing the desired signal at regular intervals is provided. The antennas at the transmitting stations are the same as used for ordinary radio communication. The wave length used at present is 1,000 meters, the present international standard for such signals, and the range of usefulness varies from 30 to 100 miles, depending upon the sensitiveness of the receiving apparatus.

THE RADIO COMPASS ON SHIPBOARD.

The method of radio direction finding, or radio fog signals, which has been developed by the Bureau of Standards and the Lighthouse Service, is based on the peculiar properties of the so-called coil aerial when used for the reception of radio signals. This coil consists of about 10 turns of insulated copper wire upon a rotatable wooden frame approximately 4 feet square. When the plane of the coil is parallel to the direction from which a radio signal emanates, the intensity of the signal received will be a maximum. As the coil is revolved, the intensity of the signal diminishes until a minimum is reached when the plane of the coil comes to a position at right angles to the line of direction from the signal. This minimum, which is well defined, may be determined with sufficient accuracy for navigational purposes and is used in taking radio bearings.

The coil aerial mounted upon a vertical spindle provided with a pointer, and a graduated circle below the pointer for determining the position of the coil with respect to a known direction, constitutes what is known as the radio compass or radio-direction finder. This apparatus, and the necessary radio-receiving device, are installed on the vessel, preferably in a position easily accessible to the navigator.

In the installations which have been made on lighthouse tenders, the coil is mounted on the roof of the pilot house. The spindle extends through the roof and is provided with a handwheel for rotating the coil. The lower end of the spindle terminates directly above the center of a standard ship's binnacle and carries a pointer so arranged that the position of the coil may be read directly upon the compass card, thus giving the magnetic bearing of the radio signal station at a glance when the minimum point is reached.

After the radio-direction finder has been installed on the vessel, a careful calibration is necessary to eliminate errors caused by distortion of the radio signal by the vessel itself. Simultaneous radio bearings and sight shots with an azimuth circle are taken on a convenient radio-signal station at intervals of approximately 5° while the vessel is swung several times in a complete circle. The deviation of the radio bearing from the true bearing is thus obtained for all positions of the coil with respect to the ship's axis. These corrections are then recorded on a circular frame of metal attached to the top of the binnacle and surrounding the magnetic compass, and applied to all subsequent readings of the radio-direction finder.

The ordinary telephone receivers, if used by the operator of the direction finder, by reason of their close proximity to the magnetic compass, would cause a deflection of the needle. This difficulty is overcome by installing a special receiver at some distance from the magnetic compass, and conducting the sound therefrom to the operator by means of rubber tubing.

The radio compass may also be mounted independently of a magnetic compass, over a fixed scale, graduated in degrees, and set with 0° for the ship's head. Radio bearings taken on this scale will give the angular difference between the ship's head and the bearing of the radio-signal station. By observing simultaneously the radio bearing and the ship's head by magnetic compass, the magnetic bearing of the radio fog-signal station is readily obtained after the manner of taking bearings with the pelorus, corrections being made for the radio bearings as mentioned in a preceding paragraph. This mounting of the radio compass will be less expensive, but also somewhat less convenient and more liable to small errors.

In order to obtain satisfactory results from radio-compass navigation it is essential that the compass be properly constructed, installed, and calibrated, and that only receivers and amplifiers of the special type required be used in connection therewith. Until commercial apparatus of this nature has been standardized and tested, care should be exercised to avoid the installation of compasses of improper design. Specifications for the construction of the improved form of radio compass have been prepared by the Bureau of Standards.

Precaution must be taken by the navigator in applying bearings taken at any considerable distance to ordinary navigation charts on the mercator projection, as the line of bearing on such a chart is not a straight line excepting in the meridian, and suitable corrections must be made.

ADVANTAGES OF THIS SYSTEM.

The following is a brief summary of some of the advantageous features of this system of radio-direction finding:

(a) The navigator can obtain bearings himself, he can do this promptly and as needed, and is not dependent upon others for the

accuracy of the results. The master of the lighthouse tender *Tulip* has for some time been regularly using the radio compass in navigating the vessel under conditions of low visibility; he has taken the bearings himself, although without any special radio training, and has found the instrument to be most helpful and reliable.

(b) Any number of vessels may obtain bearings simultaneously and as frequently as may be desired.

(c) No knowledge of radiotelegraphy is necessary on the part of the navigator.

(d) Use of the radio signal as a leading mark for which to steer directly, or to keep outside of.

(e) The direction finder may be used for locating other vessels at sea, for preventing collisions in fog, or for seeking vessels in distress.

(f) The transmitting stations, being automatic, may be operated by employees of existing lighthouses or light vessels, thus avoiding the necessity of additional personnel.

(g) This method has a strategic value, as a vessel can get bearings without disclosing its own position. As opposed to this is the fact that the shore sending stations are more apt to be disclosed and might be useful to an enemy.

HISTORICAL NOTE.

The important possibilities of utilizing the directive element of radio signals for the location of vessels in fog were early recognized. This subject was mentioned in the Lighthouse Service Bulletin in 1912 and in its annual report for 1913. The service application of the principle was dependent, however, on the improvement of the radio compass, and its successful use in this country has been rendered possible by extensive investigation of the subject by the Bureau of Standards, resulting in the development by that bureau of a simple and efficient radio compass suitable for use on shipboard.

Faraday's discovery in 1831 of electromagnetic induction was a basic step leading to the present development. The use of a coil for determining the direction of radio waves was developed by Hertz in 1888, and numbers of experimenters have worked on the problem since that time.

The French lighthouse service established in 1912 at two lighthouses on the French coast stations sending distinctive radio fog signals on a wave length of 80 meters. These were stated to be experimental and are still so listed.

In 1915 and 1916 a more effective radio compass was developed at the Bureau of Standards by F. A. Kolster, and in January, 1917, the Lighthouse Service and Bureau of Standards carried out tests of a radio sending station installed at Navesink Lighthouse, N. J., and a radio compass installed on the lighthouse tender *Tulip*, with promising results. Further development for the purposes of the Lighthouse Service was deferred during the war, but was again taken up in 1919. In October and November of that year these two services installed three experimental radio fog-signal sending stations at three lighthouses in Chesapeake Bay, and an improved radio compass on the tender *Arbutus*, and a number of tests were made with satisfactory results. During the following year the apparatus was improved, and equipment was installed at the three stations in the vicinity of New

York Harbor described herein. Tests of these stations were made in September, 1920, and later, and they were placed in regular operation May 1, 1921, and notice to mariners issued of their availability. A demonstration of their operation was given on the lighthouse tender *Tulip* June 27 and 28, 1921.

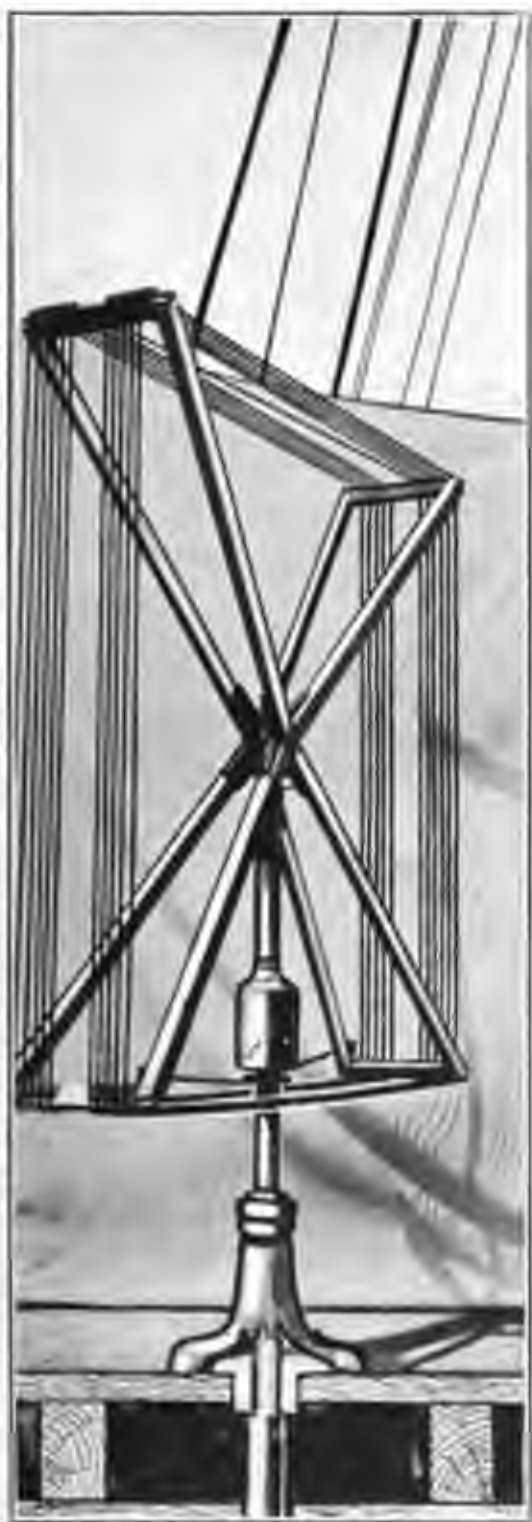
A number of tests have been made by the Navy, in cooperation with the Lighthouse Service, of a radio distance-finding apparatus, intended to permit a vessel to obtain its distance from a light vessel or other sending station by the difference of time of receipt of two signals sent simultaneously, one by radio and the other by submarine bell or other means. Such a test was made September 10, 1911, in the vicinity of Nantucket Light Vessel. An apparatus for this purpose was installed on Fire Island Light Vessel, and notice to mariners published June 10, 1917; it did not come into use as an aid, and has been discontinued. A radio telephone for the purpose of sending out warnings effective within a moderate distance was installed at Point Judith Light Station in August, 1917. It has since been discontinued.

During the World War considerable use was made abroad of radio compass stations located on shore for obtaining bearings of ships and furnishing this information for use in navigation, especially of naval vessels. After the war the Navy Department established such stations on the coast of the United States, to be operated in conjunction with the naval communication stations already existing. An extensive and successful test of a number of these stations was made with the cruiser *Chicago* in May, 1919. A number of such stations are now in active operation on both the Atlantic and Pacific coasts, and are furnishing many bearings to ships asking for them. These stations are usually arranged in groups. The system is the reverse of that employed by the Lighthouse Service at its stations in which the navigator determines the position of the ship himself.

ELEMENTARY EXPLANATION OF THE PRINCIPLES OF OPERATION OF THE RADIO COMPASS.¹

The coil type of antenna used as a radio compass has strongly marked directional properties. Radio waves have the properties of the more familiar kinds of waves, but travel with a velocity of 300,000,000 meters per second. A radio wave from a transmitting station spreads out symmetrically from the station with uniform intensity, very much as waves spread out on a quiet pond when a stone is dropped in. In a given direction from the transmitting station, at a given instant the distance between successive wave crests is the wave length. Radio waves are accompanied by a magnetic force, which is horizontal and at right angles to the direction in which the waves are traveling. As a radio wave passes a given point, the magnetic force or field strength varies from moment to moment from a maximum in one direction through zero to a maximum in the other direction. At a given point, the cycle from maximum in one direction back to maximum in the same direction is performed in a

¹ Mainly from the Bureau of Standards notes.



RADIO COMPASS AS INSTALLED ON THE LIGHTHOUSE TENDER "TULIP."

By means of this movable coil mounted on a ship a navigator may obtain accurate bearings on invisible stations sending radio fog signals. Left, compass coil on deck of pilot house. Right, binnacle and magnetic compass in the pilot house directly below the coil, showing handwheel for turning radio compass coil and attached sight wires for reading the bearings.



RADIO FOG SIGNAL STATION AT SEA GIRT, N. J., LIGHTHOUSE, SHOWING ANTENNA TOWERS.

The automatic apparatus for sending radio signals, three dashes at brief intervals, is located in a small room of the building, and is in charge of the one regular lightkeeper at this station.

When the coil is turned in the direction in which the radio wave is traveling, the following is a proportional expression for the received current in a coil antenna:

$$I \text{ is proportional to } \frac{hlNH}{Rw}.$$

where

h is the height (length of the vertical side) of the receiving coil aerial or direction finder.

l is the length (horizontal side) of the receiving coil aerial.
(Therefore, hl is the area of the coil.)

N is the number of turns of the coil.

H is the field produced by the transmitting station at the point where the direction finding coil is located.

R is the resistance of the circuit of the receiving coil aerial.

w is the wave length of the transmitted wave.

The small dimensions of the coil render its installation practicable on shipboard, but they result in a system of extremely low efficiency, so that to make a workable instrument very great amplification is necessary. The vacuum tube multistage amplifier is therefore essential to the employment of such small coils for radio compass purposes, and its introduction was an important step in making the instrument usable for this purpose.

FUTURE DEVELOPMENT.

The Lighthouse Service proposes, as means are available and needs are developed, to install similar groups or single radio fog-signal stations in the vicinity of important entrances on the Atlantic and Pacific coasts of the country and on the Great Lakes, as well as on some of the principal intermediate capes and light vessels. For the successful utilization of the system it is, of course, indispensable that the more valuable vessels at least be equipped with radio compasses, and it is believed that the additional safeguards resulting from such equipment will bring this about, particularly in view of the growing familiarity with the value of radio apparatus to shipping. As a result of further investigation still in progress by the services mentioned and others, and of actual test and experience, it is expected there will be improvements in this system and further applications of radio signaling for the safeguarding of navigation. It is not probable, however, that as a result of anything now in sight the extensive system of sound fog signals, such as sirens, whistles, horns, and bells, can be dispensed with, as these are of great value to vessels and boats of every size and description, many of which are not likely to be equipped for receiving radio signals; and furthermore, these furnish warning signals the use of which is not dependent on the operation of any instrument other than the human ear.

It may be desirable to develop this system for the location of vessels in clear weather, at distances beyond the visibility of lights or other objects on land, and this may readily be done if sufficiently useful.

STATISTICS AND ESTIMATES.

LIST OF OFFICERS OF THE BUREAU OF LIGHTHOUSES AND THE LIGHTHOUSE DISTRICTS.

OFFICERS OF THE BUREAU OF LIGHTHOUSES ON JUNE 30, 1921.

George R. Putnam.....	Commissioner of Lighthouses.
John S. Conway.....	Deputy Commissioner.
H. B. Bowerman.....	Chief Constructing Engineer.
Edward C. Gillette.....	Superintendent of Naval Construction.

Principal Assistant Engineer, Rudolph Zirpel.
 Superintendent on general duty, E. M. Trott.
 Chief Clerk, Thaddeus S. Clark.
 Examiner, Thomas Flood.

SUPERINTENDENTS OF LIGHTHOUSE DISTRICTS JULY 1, 1920, TO JUNE 30, 1921.

District.	Name.	From—	To—
1st.....	C. E. Sherman.....	July 17, 1911	
2d.....	G. E. Eaton.....	Mar. 7, 1919	
3d.....	J. T. Yates.....	June 20, 1912	
4th.....	B. B. Dorry.....	July 1, 1919	
5th.....	H. D. King.....	Jan. 28, 1915	
6th.....	H. L. Beck.....	do.....	
7th.....	W. W. Demeritt.....	Aug. 22, 1913	
8th.....	E. S. Lanphier.....	July 1, 1919	
9th.....	F. C. Hingsburg.....	Jan. 28, 1918	Sept. 6, 1920
	F. P. Dillon.....	Sept. 7, 1920	
10th.....	Roscoe House.....	June 4, 1912	
11th.....	E. L. Woodruff.....	Aug. 19, 1912	
12th.....	C. H. Hubbard.....	May 1, 1918	
13th.....	Col. H. Burgess, Corps of Engineers, U. S. Army.....	June 9, 1919	
14th.....	Lieut. Col. W. P. Stokey, Corps of Engineers, U. S. Army ..	Apr. 22, 1920	
15th.....	Col. Chas. L. Potter, Corps of Engineers, U. S. Army	Apr. 6, 1920	
16th.....	W. C. Dibrell.....	Aug. 22, 1913	
17th.....	Robert Warrack.....	Feb. 1, 1915	
18th.....	H. W. Rhodes.....	July 6, 1912	
19th.....	A. E. Arledge.....	Sept. 3, 1912	

JURISDICTION OF LIGHTHOUSE SERVICE.

The United States Lighthouse Service is charged with the establishment and maintenance of aids to navigation and with all equipment and work incident thereto on the sea and lake coasts of the United States, on the rivers of the United States so far as specifically authorized by law, and on the coasts of all other territory under the jurisdiction of the United States, with the exception of the Philippine Islands and Panama. The total length of coast line and rivers under the United States Lighthouse Service, measured by steps of 3 miles, is approximately 49,012 statute miles.

LIMITS OF LIGHTHOUSE DISTRICTS AND ADDRESSES OF SUPERINTENDENTS OF LIGHTHOUSES.

District.	Limits of district.	Address of superintendents.
1st.....	Waters of Maine and New Hampshire.....	Y. M. C. A. Building, Portland, Me.
2d.....	Waters of Massachusetts.....	Customhouse, Boston, Mass.
3d.....	Waters of Rhode Island, Connecticut, New York, and New Jersey northward of Cape May.	Lighthouse Depot, Tompkinsville, N. Y.
4th.....	Waters of Delaware seacoast and Delaware Bay and River.	Post Office Building, Philadelphia, Pa.
5th.....	Waters of Maryland, Virginia, and North Carolina to and including New River Inlet, N. C.	New Customhouse, Baltimore, Md.
6th.....	Waters of North Carolina, South Carolina, Georgia, and Florida from New River Inlet, N. C., to Hillsboro Inlet, Fla.	Old Post Office Building, Charleston, S. C.
7th.....	Waters of Florida from Hillsboro Inlet to Cedar Keys..	Federal Building, Key West, Fla.
8th.....	Waters of Gulf Coast from Cedar Keys, Fla., to mouth of Rio Grande, Tex., and Mississippi River below New Orleans.	Customhouse, New Orleans, La.
9th.....	Waters of Porto Rico and adjacent United States islands.	Insular Buildings, San Juan, P. R.
10th.....	United States waters of St. Lawrence River and Lakes Ontario and Erie.	Federal Building, Buffalo, N. Y.
11th.....	United States waters of Lakes St. Clair, Huron, and Superior, and Detroit River.	Post Office Building, Detroit, Mich.
12th.....	Waters of Lake Michigan and Green Bay.....	Federal Building, Milwaukee, Wis.
13th.....	Mississippi River above the mouth of the Missouri River, Minnesota, Illinois, Osage, Gasconade, and Missouri Rivers, St. Croix River and Lake.	Federal Building, Rock Island, Ill.
14th.....	Ohio, Tennessee, Kanawha, and Monongahela Rivers.	Customhouse, Cincinnati, Ohio.
15th.....	Mississippi River below the Missouri River to New Orleans, La., and Red River.	Old Customhouse, St. Louis, Mo.
16th.....	Waters of Alaska.....	Heckman Building, Ketchikan, Alaska.
17th.....	Waters of Washington and Oregon.....	Customhouse, Portland, Oreg.
18th.....	Waters of California.....	Customhouse, San Francisco, Calif.
19th.....	Waters of Hawaiian, Midway, Guam, and American Samoan Islands.	McCandless Building, Honolulu, Hawaii.

LIGHTHOUSE DEPOTS MAINTAINED ON JUNE 30, 1921.

[The principal depot of the district is indicated by the larger type.]

District.	Location.	District.	Location.
1st.....	Bear Island, Me.	8th.....	Fort San Jacinto, Galveston, Tex.
	LITTLE DIAMOND ISLAND, ME.		Mobile, Ala.
2d.....	LOVELLS ISLAND, BOSTON, MASS.		PORT EADS, LA.
	Woods Hole, Mass.	9th.....	SAN JUAN, P. R.
	Chelsea, Mass.	10th.....	BUFFALO, N. Y.
3d.....	Atlantic City, N. J.		Erie, Pa.
	Goat Island, R. I.		Maumee Bay, Ohio.
	Juniper Island, Vt.		Rock Island, N. Y.
	New London, Conn.		Sandusky Bay (Cedar Point), Ohio.
	TOMPKINSVILLE, STATEN ISLAND, N. Y.	11th.....	DETROIT, MICH.
	Tucker Beach, N. J.		Minnesota Point, Minn.
4th.....	EDGEMOOR, DEL.		St. Marys River, Mich.
	Lewes, Del.	12th.....	Charlevoix, Mich.
5th.....	Annapolis, Md.		MILWAUKEE, WIS.
	Lazaretto Point, Md.	16th.....	KETCHIKAN, ALASKA.
	Point Lookout, Md.	17th.....	Ediz Hook, Wash.
	PORTSMOUTH, VA.		TONGUE POINT, OREG.
	Washington Wharf, D. C.	18th.....	GOAT ISLAND, CALIF.
	Washington, N. C.	19th.....	HONOLULU, HAWAII.
6th.....	CHARLESTON, S. C.		
7th.....	Egmont Key, Fla.		
	KEY WEST, FLA.		

EXPLANATION OF TABLE ON PAGE 35.

The table of aids to navigation includes all those maintained by the Lighthouse Service, a total of 16,356. On page 39 are given facts regarding the private aids to navigation, 774 in number, maintained under authority. In the statistics relief light vessels and duplicate or auxiliary lights and fog signals are not counted, but double lights are counted separately when maintained on distinct structures or for distinct purposes. Buoys for the purpose of marking the positions of light vessels or larger buoys are not counted. Fog signals at light stations or on vessels are counted as separate aids, but not those attached to buoys, except in the case of submarine bells, which are counted as separate signals, whether on vessels or on buoys. Otherwise each buoy is counted only once, and if it is included in a higher class it is not in the lower class. Light-vessel lights are not counted separately.

[See note on p. 34.]

Class.	1st dist.	2d dist.	3d dist.	4th dist.	5th dist.	6th dist.	7th dist.	8th dist.	9th dist.	10th dist.	11th dist.	12th dist.	13th dist.	14th dist.	15th dist.	16th dist.	17th dist.	18th dist.	19th dist.	Total.
LIGHTED AIDS.																				
Hydro-radiant lights.																				1
First-order lights.	2	5	5	2	8	8	6	3				2					9		1	57
Second-order lights.	7	3	2			2	1	2	1		3	2						1	2	26
Third-order lights.	6		3	2		3	3	8	6	4	10	9				4	2	4	1	66
Three- and four- half order lights.			1		1			3	1	3	6	2							1	24
Fourth-order lights.	35	25	38	9	49	2	4	12	4	22	45	37				5	19	20	7	353
Fifth-order lights.	18	15	18	4	19	3	1	13	3	9	11	12						2		128
Sixth-order lights.	1	5	21	2	8				4	8	3	15								67
Range-aids.			9	15	5	12				6	4						2			53
Reflector lights.	2	7	1	11	19	39	13	8	2	7	29	4					4			146
Beacon lights.	12	32	84	22	45	63	36	184	20	40	103	52				115	34	42	30	923
Minor lights.	3	14	144	27	300	180	77	97	2		76	7	366	581	770	75	306	17	2	3,044
Electric lights without lens.	1								5							1	6	1	2	16
Light-vessels (floats).	1	11	10		6	4		2			4	6					3	2		49
Gas-lighted buoys.	6	43	52	13	71	11	8	28	6	33	80	17					13	8	23	415
Gas and electric buoys.	7	6	11		11	8	5	8	1			1				2	7	9		76
Gas and metal ball buoys.		10	23	8	22	8	7	6		2	11	17				8	7	8	1	138
Floatlights.									1	22	5	5	96	36		6	3			174
Total.	101	179	442	115	564	344	161	374	56	156	390	186	462	617	770	219	415	123	79	5,756
UNLIGHTED AIDS.																				
Lights on fixed aids.	87	109	346	97	454	313	141	330	48	99	200	140	366	581	770	200	382	96	55	4,904
Lights on floating aids.	14	70	96	21	110	31	20	44	8	57	100	46	96	36		19	33	27	24	852
Total lighted aids.	101	179	442	118	564	344	161	374	56	156	390	186	462	617	770	219	415	123	79	5,756
Fog signals, engine power.	19	21	37	5	14	4		4		11	39	47				10	26	30		267
Fog signals, clock power.	37	11	58	6	61	3	1	15		5	4	9				1	7	7		228
Fog signal compressed gas.					2															2
Fog signals, hand power.	12	1	2								1	1								17
Fog signals, electric.		6	6	1	3						7						3	4		28
Fog signals, radio.			3																	3
Submarine signals.	2	8	9		7	5		2			5	4					4	2		48
Buoys, whistling (unlighted).	19	10	8		1	5	2	5	1								8	17		76
Buoys, bell (unlighted).	52	30	60	5	31	9	6	13	4	1	1	2				2	7	16		248
Buoys, horn.	144	62	203	103	272	302	201	179	124	9	25	20				175	122	63	46	2,059
Buoys, star (wood).	714	615	882	101	984	6		258		158	500	144	541			48	135	36	12	5,134
Daymarks, beacons, etc.	177	75	38	1	368	567	392	244	10		4	8	300	61		93	77	30	45	2,490
Total unlighted aids.	1,176	851	1,306	222	1,743	901	602	719	139	184	586	244	841	61		329	387	205	103	10,600
Grand total.	1,277	1,030	1,748	340	2,307	1,245	763	1,093	195	340	976	430	1,303	678	770	548	802	328	182	16,356

DETAILS AS TO CHARACTERISTICS OF LIGHTS (NOT INCLUDING LIGHT VESSELS).¹

	1st dist.	2d dist.	3d dist.	4th dist.	5th dist.	6th dist.	7th dist.	8th dist.	9th dist.	10th dist.	11th dist.	12th dist.	16th dist.	17th dist.	18th dist.	19th dist.	Total.
Fixed white:																	
Sixth order and above...	31	29	51	16	58	27	4	28	5	18	24	23	1	3	2	4	324
Below the sixth order...	1	10	73	9	228	138	55	148	4	5	58	6	51	218	18	11	1,033
Lighted buoys.....		1	5					1		10	2	5	1	2		10	37
Fixed red:																	
Sixth order and above...	14	10	22	2	20	20	9	8	2	18	33	27		5		3	193
Below the sixth order...	5	13	98	9	92	70	37	117	8	15	60	17	6	98	24	9	687
Lighted buoys.....			6						1	12	3	1	5	1		5	34
Fixed green:																	
Below the sixth order...									1								1
Flashing or occulting:																	
Sixth order and above...	15	18	40	30	28	22	14	10	11	21	45	18	8	25	34	7	346
Below the sixth order...	9	23	57	31	25	24	21	16	14	20	61	35	134	30	18	23	541
Lighted buoys.....	13	58	75	21	104	27	20	41	7	35	91	34	13	27	25	9	600
Fixed and flashing, sixth order and above.....	12	6	5		3	3	1	3	3	2	9	14		3			64
Candlepower:																	
50,000 to 190,000.....	5	4	4	7	4	6	5	5	3	4	7	1	1	2	9	1	68
200,000 to 490,000.....		1	2	1	1	1	1	1			3	1	1	1	2	1	17
500,000 and over.....		1	1												1	1	4
Twin light stations.....	2	3															5
Stations with resident keepers.....	70	47	111	32	81	22	13	49	21	37	68	66	11	35	39	14	716

DETAILS AS TO ILLUMINANTS OF LIGHTS (NOT INCLUDING LIGHT VESSELS).¹

	1st dist.	2d dist.	3d dist.	4th dist.	5th dist.	6th dist.	7th dist.	8th dist.	9th dist.	10th dist.	11th dist.	12th dist.	16th dist.	17th dist.	18th dist.	19th dist.	Total.
Incandescent oil vapor.....	28	25	39	19	20	15	11	13	12	8	39	29	5	25	26	6	320
Oil (wick lamps):																	
Sixth order and above...	43	30	76	6	67	42	12	35	8	33	27	39	1	2	2	7	430
Below the sixth order...	6	15	154	16	301	217	92	228	4	16	78	19	56	300	37	14	1,553
Lighted buoys.....									1	22	5	5	6				42
Acetylene:																	
Sixth order and above...		3	2	14	11	15	3	7	2	6	20	4	3	2		1	95
Below the sixth order...	9	23	69	29	25	24	21	47	8	18	44	35	134	19	16	23	544
Lighted buoys.....	7	31	53	11	65	27	17	19	1		25	8	13	22	13	24	336
Oil gas:																	
Lights with mantles.....											48						48
Lights without mantles.....					15						1						16
Lighted buoys with mantles.....	2		8	2	38			2	2	35	66	25		5	7		192
Lighted buoys without mantles.....	4	28	25	8	2		3	21	6			2			5		104
Electric arc:																	
Sixth order and above...															1		1
Electric incandescent:																	
Sixth order and above...	1	3	2	9	11		2		5	12	17	9		7	6		84
Below the sixth order...		8	3	4	3				7	6	16	4	1	27	6	6	91
Gas (coal), sixth order and above.....		2										1					3
Gas oil, below sixth order.....			1														1

¹ Does not include the 13th, 14th, and 15th lighthouse (river) districts, in which there are 1,721 lights on fixed aids and 128 lights on floating aids, all of which use kerosene and are fixed, excepting 5, which use acetylene and are flashing, and 1 which uses electricity

DETAILS AS TO LIGHTS ON LIGHT VESSELS.

	1st dist.	2d dist.	3d dist.	5th dist.	6th dist.	8th dist.	11th dist.	12th dist.	17th dist.	18th dist.	Total.
Characteristics as to lights:											
1 fixed white light.....		1					3	4			8
2 fixed white lights.....		2	3	1		1			2	1	10
1 fixed white and 1 fixed red light.....		1			1				1		3
1 white flashing, or occulting, and 1 fixed red light.....			2								2
1 white light, flashing or occulting.....	1	7	5	4	3	1	1	2		1	25
2 white lights, flashing or occulting.....				1							1
Illuminants:											
Incandescent oil vapor.....						1					1
Acetylene.....	1	6	6	4	3						20
Oil (wick).....		4	2	1	1	1	3	4	3	1	20
Oil (wick) and acetylene.....			1								1
Electric arc.....			1								1
Electric incandescent.....		1		1			1	2		1	6
Illuminating apparatus:											
Fourth order.....				1	1	1		1			4
Reflector.....		2	2	1	1		2	1	1		10
Reflector and lens lantern.....			2								2
Lens lantern.....	1	9	6	4	2	1	2	4	2	2	33

DETAILS AS TO FOG SIGNALS.

Kind and how operated.	1st dist.	2d dist.	3d dist.	4th dist.	5th dist.	6th dist.	7th dist.	8th dist.	10th dist.	11th dist.	12th dist.	16th dist.	17th dist.	18th dist.	Total.
Radio.....			3												3
Steam:															
Whistle.....	8	5	6		4	2		1	3	28	28		3	5	93
Siren.....			1										1	1	3
Air:															
Whistle.....	1	4	1								3				9
Siren.....	2	4	22	1	5	1		1	3	8	10	5	6	15	83
Diaphone.....		1			1	1		1	5	3	5	1	2	9	29
Siren (electric).....			2	1						4			1	4	12
Reed horn.....	8	6	7	4	4			1				4	14		48
Submarine bells:															
On light vessels, driven by compressed air.....	1	7	7		6	3		2		3	4		3	2	38
On bottom, electric power.....										2					2
On buoys, operated by sea.....	1	1	2		1	2							1		8
Bell:															
Clockwork.....	37	14	58	6	61	3	1	15	5	4	9	1	4	7	225
Electric.....		6	5		3					3			2		19
Operated by gas.....					2										2
Engine.....		1													1
Hand.....	12	1	2												15
Horn: Hand.....										1	1				2
Total.....	70	50	116	12	87	12	1	21	16	56	60	11	38	43	503

¹ Auxiliary fog signals (74), buoys with whistles (152), and buoys with bells (386) are not included.

LIGHTS WHERE ILLUMINATION WAS IMPROVED DURING THE FISCAL YEAR 1921.

FLASHING OR OCCULTING LIGHTS CHANGED FROM FIXED LIGHTS (35 LIGHTS).

District.	Location.	District.	Location.
2d.....	Boston Light Vessel No. 54, Mass.	10th.....	Olcott Harbor, N. Y.
3d.....	Brenton Reef Light Vessel No. 39, R. I.		Oswego Harbor, N. Y.
5th.....	Bowlers Rock, Rappahannock River, Va.	11th.....	Frying Pan Island, Mich.
5th.....	Arlington Cut, St. Johns River, Fla. (2 lights).		Grand Marais, Mich.
	Cross-Over Range Front, St. Johns River, Fla.		Mamajuda, Detroit River, Mich.
	Fort George Island Range Front, St. Johns River, Fla.		Middle Neebish Cut, St. Marys River, Mich. (8 lights).
	Wards Bank Range Front, St. Johns River, Fla.	12th.....	Point of Woods, Mich.
7th.....	Miami Entrance, Fla.		Sand Island, Wis.
8th.....	St. Philips Bend, Mississippi River, La.	16th.....	Lansing Shoal Light Vessel No. 98, Mich.
9th.....	Guantanamo Bay, Cuba (3 lights).		Killisnoo Harbor, Chatham Strait, Alaska (2 lights).
	Jobos Harbor, P. R.		Murder Cove, Frederick Sound, Alaska.
		17th.....	Blakely Rock, Puget Sound, Wash.
		18th.....	Petaluma Creek, Calif.

INCANDESCENT OIL-VAPOR LIGHTS CHANGED FROM OIL-WICK LIGHTS (2 LIGHTS).

5th.....	Old Plantation Flats, Chesapeake Bay, Va.	9th.....	Point Borinquen, P. R.
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ACETYLENE OR OTHER LIGHTS CHANGED FROM OIL-WICK LIGHTS, ETC. (69 LIGHTS).

2d.....	Boston Light Vessel No. 54, Mass. (from i. o. v.).	11th.....	Frying Pan Island, Mich.
3d.....	Brenton Reef Light Vessel No. 39, R. I.		Grand Marais, Lake Superior, Mich.
	Common Fence Point shoal gas buoy, R. I.		Keweenaw Waterway, Mich. (11 lights; electric incandescent).
	Little Peconic Bay, N. Y. (4 gas buoys).		Mamajuda, Detroit River, Mich.
	North Brother Island, East River, N. Y. (electric incandescent).		Middle Neebish Cut, St. Marys River, Mich. (9 lights).
5th.....	Bowlers Rock, Rappahannock River, Va.		Pipe Island, St. Marys River, Mich.
	Kettle Bottom Shoals Gas Buoy, Potomac River, Md.		Point of Woods Range, Mich. (2 lights).
	Smiths Point Shoal Gas Buoy, Potomac River, Md.	12th.....	Portage Lake Ship Canals West Breakwater, Mich. (from oil gas).
6th.....	Arlington Cut, St. Johns River, Fla.		Sand Island, Wis.
	Cross-Over Range Front, St. Johns River, Fla.		Indiana Shoal Gas and Bell Buoy, Ind.
	Fort George Island Range Front, St. Johns River, Fla.		Lansing Shoal Light Vessel No. 98, Mich. (electric incandescent).
	Wards Bank Range Front, St. Johns River, Fla.		South Fox Island Shoal Gas Buoy, Mich.
7th.....	Miami Entrance, Fla.	16th.....	Killisnoo Harbor, Chatham Strait, Alaska (2 lights).
8th.....	St. Philips Bend, Mississippi River, La.		Murder Cove, Frederick Sound, Alaska.
9th.....	Guantanamo Bay, Cuba (4 lights; electric incandescent).	17th.....	Astoria Range, Columbia River, Oreg. (2 lights).
	Jobos Harbor, P. R.		Blakely Rock, Puget Sound, Wash.
	Judge Berge Range, St. Thomas, V. I. (2 lights; electric incandescent).		Slaughters, Columbia River, Wash.
10th.....	Ashtabula West Pier, Ohio (electric incandescent).	18th.....	Waterman Point, Puget Sound, Wash.
	Conneaut West Breakwater, N. Y. (electric incandescent from acetylene).		Petaluma Creek, Calif.
	Olcott, N. Y.		Santa Barbara, seacoast of Calif. (electric incandescent from i. o. v.).
	Oswego Harbor, N. Y. (electric incandescent from i. o. v.).		

FOG SIGNALS IMPROVED DURING THE FISCAL YEAR 1921.

District.	Location.	Character.	
		From—	To—
5th	Bowlers Rock, Rappahannock River, Va...	Bell operated by clock-work.	Bell operated by compressed gas.
12th	Lansing Shoal Light Vessel No. 98, Mich...	Steam whistle	Air siren.

PRIVATE AIDS TO NAVIGATION MAINTAINED ON JUNE 30, 1921.

[Under the act of June 20, 1906.]

District.	Lights.	Buoys.		Other unlighted aids.	Fog signals.	Total.
		Lighted.	Unlighted.			
1st.....			31	1		32
2d.....	40	3	47	6		96
3d.....	34	38	51	1	2	91
4th.....			2			2
5th.....	18		173	48	3	242
6th.....	2		10			12
7th.....	5		9	5		19
8th.....	19		20	7		46
9th.....			1			1
10th.....	24	4	4	1	1	34
11th.....	12	1	54	1		68
12th.....	30	3	9		8	50
13th.....		1				1
15th.....	2					2
16th.....	2		1			3
17th.....	1		12		2	15
18th.....	23	2	3	2	13	43
19th.....	15		2			17
Total.....	227	17	429	72	29	774

BRIDGES OVER NAVIGABLE WATERS LIGHTED ON JUNE 30, 1921.

[Under the act of Aug. 7, 1882, 22 Stat., 309.]

District.	Lighted bridges.	District.	Lighted bridges.	District.	Lighted bridges.
1st.....	20	7th.....	27	14th.....	187
2d.....	63	8th.....	261	15th.....	8
3d.....	217	10th.....	68	17th.....	55
4th.....	17	11th.....	53	18th.....	30
5th.....	159	12th.....	196		
6th.....	60	13th.....	80	Total.....	1,501

AIDS MAINTAINED UNDER CONTRACT DURING FISCAL YEAR 1921.

District.	Name of aids.	Annual cost.
1st.....	Kennebunkport Pier Light, Me.....	\$150.00
7th.....	Caximbas Pass and Big Marco Pass, Fla. (4 buoys).....	71.40
	Miami Municipal Channel, Fla. (5 buoys).....	72.00
10th.....	Lake Ontario and the St. Lawrence River, N. Y. (40 buoys).....	3,000.00
11th.....	Superior Bay, St. Louis Bay and River, Wis. and Minn. (34 lights).....	3,300.00
16th.....	St. Michael Canal and Apoon Pass, Alaska (32 buoys); Orizaba Reef Bell Buoy and Norton Sound (11 lights).	1,142.00
	Sitka Harbor Light, Alaska.....	60.00
	Akutan Harbor Light, Alaska.....	56.00

LIGHT VESSELS IN COMMISSION DURING THE FISCAL YEAR 1921.

Station.	On sta- tion.	Original cost.	Cost of maintenance during fiscal year.	Cost of repairs made during fiscal year.	Illuminant.	Fog signal.	Regular comple- ment.		Indicated horsepower (self-propelling).	Dimensions.			Material of hull.	When built.	Tonnage.		Battery.
							Officers.	Crew.		Length overall.	Breadth.	Depth.			Gross.	Net.	
	Months.									<i>ft. in.</i>	<i>ft. in.</i>	<i>ft. in.</i>					
73 Portland, Me.	10	\$88,896	\$25,525	\$2,340	Acet.	12" steam whistle ^b	4	8	180	129 9	28 6	13 0	Wood	1892	1,407		1
74 Haddam Neck, Conn.	5																
75 Haddam Neck, Conn.	22	12,000	10,537	1,020	do.	Bell	2	5	(9)	10 0	0	0	do.	1892	144		1
76 Southport, Conn.	26		1,882	4,797	Oil	Bell or horn ^b	1	0	(4)	10 0	0	0	do.	1855	104		1
77 Cape Hen, Conn.	6		13,651	4,201	Acet.	8" air whistle	1	2	(3)	9 0	0	0	do.	1864	161		1
78 Cape Hen, Conn.	8		25,040	36	do.	Bell	2	5	(6)	10 0	0	0	do.	1867	165		1
79 Cape Hen, Conn.	26		10,183	1,914	Oil	12" air whistle ^b	2	7	(5)	10 0	0	0	do.	1876	164		1
80 Cape Hen, Conn.	4	19,883	13,634	0,715	do.	First-class air siren ^b	3	3	(5)	11 0	0	0	do.	1876	187		1
81 Cape Hen, Conn.	17	35,000	17,332	0,715	Oil	10" air whistle	3	7	(5)	10 0	0	0	do.	1877	410		1
82 Cape Hen, Conn.	11	40,796	16,074	1,846	do.	12" steam chime wh. b.	4	7	(5)	11 0	0	0	Comp.	1891	1,450		1
83 Cape Hen, Conn.	19	60,000	16,962	0,920	Acet.	12" steam chime wh. b.	4	7	(5)	11 0	0	0	Steel	1892	1,110		1
84 Cape Hen, Conn.	9	62,030	20,674	2,731	do.	First-class air siren ^b	4	7	(5)	11 0	0	0	Comp.	1895	1,590		1
85 Cape Hen, Conn.	12	69,282	21,134	69	Oil	do.	4	8	(5)	12 9	0	0	Steel	1901	1,578		1
86 Cape Hen, Conn.	9	79,872	23,142	2,160	Oil	do.	4	8	(5)	12 9	0	0	do.	1907	1,681		1
87 Cape Hen, Conn.	8	99,000	31,619	2,662	El. inc.	do.	5	10	(5)	13 5	5	0	do.	1907	1,682		1
88 Cape Hen, Conn.	23	99,000	21,141	1,289	Oil	do.	4	6	(5)	13 5	5	0	do.	1907	1,683		1
89 Cape Hen, Conn.	6	107,213	26,156	2,193	do.	do.	4	6	(5)	13 5	5	0	do.	1908			1
90 Cape Hen, Conn.	14																
91 Scotland, N. J.	11	13,462	10,328	529	Acet.	Bell	2	5	(9)	11 6	8	0	Wood	1853	320		3
92 Scotland, N. J.	5	12,000	12,805	115	do.	10" air whistle	4	6	(9)	10 4	8	0	do.	1851	155		3
93 Scotland, N. J.	9	28,084	7,747	1,683	do.	First-class air siren, 10" whistle ^b	2	3	(9)	11 0	6	0	do.	1854	250		3
94 Ram Island Reef, Conn.	0				do.	Bell	2	5	(9)	9 0	0	0	do.	1857	186		3
95 Ram Island Reef, Conn.	20	7,500	9,170	27	do.	10" and 6" air whistle ^b	4	6	(9)	13 0	9	0	do.	1875	387		3
96 Northeast End, N. J.	18	50,000	18,775	3,811	do.	First-class team siren ^b	4	8	(9)	10 6	0	0	Iron	1882	197		3
97 Cornfield Point, Conn.	17	52,780	14,450	2,665	Acet. and oil.	First-class air siren	4	6	(9)	12 0	8	0	Comp.	1891	1,470		3
98 Fire Island, N. Y.	9	74,750	20,549	2,660	Acet.	12" steam chime wh. b.	4	10	(350)	122 10	6	0	do.	1897	1,590	204	3
99 Overfalls, Del.	8	79,500	20,226	1,525	do.	do.	4	10	(350)	122 10	6	0	do.	1897	1,590	204	3
100 Relief	0	89,030	19,965	6,672	do.	10" steam whistle ^b	4	6	(325)	129 0	6	0	Steel	1904	1,668	188	3
101 Five-Fathom Bank, N. J.	15	89,000	18,621	5,588	Oil	steam siren and bell.	4	8	(325)	129 0	6	0	do.	1904	1,668	188	3
102 Ambrose Channel, N. Y.	19	99,000	22,100	3,998	El. inc.	12" steam chime wh. b.	4	10	(325)	135 5	0	0	do.	1907	1,683	246	3

2	Relief.	5	210	1849	Wood.	298	0	25	0	9	0	(*)	1	0	Bell.	Oil.	3,525	12,402	10	20
46	Tail of the Horseshoe, Va.⊙	5	1401	1887	Steel	124	6	27	6	12	0	(*)	4	6	12" steam whistle b.	do.	18,350	60,000	4	12
49	Relief	5	1470	1890	Comp.	120	10	27	0	14	0	(*)	4	6	First-class air siren b.	Acet.	2,766	57,900	4	12
52	Fenwick Island Shoal, Del.⊙	5	1416	1892	Iron.	118	10	26	6	12	0	180	4	9	do b.	do.	10,363	62,000	10	3
72	Diamond Shoal, N. C.⊙	5	1693	1900	Steel.	123	6	28	6	14	0	350	5	10	12" steam chime wh. b.	El. inc.	28,572	89,000	9	21
80	Cape Lookout Shoals, N. C.⊙	5	1668	1896	do.	129	0	28	6	12	6	500	4	10	do b.	Oil.	4,945	85,000	12	0
91	Winter-Quarter Shoal, Va.⊙	5	1685	1908	do.	135	5	29	0	13	0	400	4	10	do b.	Acet.	4,182	107,213	10	25
101	Cape Charles, Va.⊙	5	1360	1916	do.	101	10	25	0	13	2	200	4	7	First-class air siren b.	do.	2,182	108,507	12	0
1	Martins Industry, S. C.⊙	6	275	1855	Wood.	103	0	24	0	13	0	(*)	2	8	do b.	Oil.	15,670	...	12	0
34	Charleston, S. C.	6	150	1864	do.	101	10	23	0	10	0	(*)	2	7	Air diaphone.	Acet.	410	48,000	10	16
53	Relief	6	310	1892	Iron.	119	0	26	6	11	0	135	4	9	12" steam whistle b.	do.	10,185	61,548	3	20
84	Brunswick, Ga.	6	1683	1907	Steel.	135	5	29	0	13	0	325	4	10	do b.	do.	2,068	93,000	12	0
94	Frying-Pan Shoals, N. C.	6	1670	1911	do.	135	6	29	0	13	0	363	4	10	do b.	do.	1,045	104,004	9	28
81	Heald Bank, Tex.	8	1668	1904	do.	120	0	28	6	12	6	325	4	8	do b.	Oil.	5,748	90,000	8	14
102	South Pass, La.	8	1300	1916	do.	101	10	25	0	13	2	200	4	7	First-class air siren b.	Inc. o. v.	6,517	110,065	6	26
61	Relief	11	105	1893	Wood.	87	2	21	0	9	0	(*)	3	3	6" steam whistle b.	Oil.	868	14,098	3	0
62	Bar Point Shoal, Mich.	11	105	1891	do.	87	2	21	6	8	0	(*)	2	2	do.	do.	...	14,088	...	...
75	Lake St. Clair, Mich.	11	160	1902	Steel.	83	9	24	0	4	9	(*)	2	2	Bell.	do.	620	14,998	8	19
82	Relief	11	209	1912	do.	95	2	21	0	8	11	90	4	3	10" steam whistle b.	Acet.	478	42,910	5	4
89	Martin Reef, Mich.	11	205	1908	do.	88	3	21	0	10	0	90	4	3	6" steam whistle b.	Oil.	523	37,500	8	3
96	Lake Huron, Mich.	11	2170	1914	do.	101	0	23	6	11	5	(*)	3	4	First-class air siren b.	El. inc.	674	71,232	8	5
99	Pae Reef, Mich.	11	215	1920	do.	91	5	22	0	10	7	125	4	3	10" steam whistle.	Acet.	10,056	97,220	...	...
55	Lansing Shoal, Mich.	12	129	1891	Wood.	102	5	20	0	9	0	100	4	2	6" steam whistle b.	Oil.	105	13,600	2	14
56	North Manitowish Shoal, Mich.	12	130	1891	do.	102	8	20	0	8	10	100	4	2	do b.	do.	176	13,600	7	26
57	Grays Reef, Mich.	12	130	1891	do.	102	8	20	0	8	10	100	4	2	do b.	do.	450	13,600	7	26
60	Eleven-Foot Shoal, Mich.	12	105	1893	do.	87	2	21	6	8	6	(*)	3	3	10" steam whistle b.	do.	195	13,900	7	17
77	Piedra Reef, Wis.	12	155	1906	Steel.	75	0	21	6	4	0	(*)	2	3	8" air chime whistle.	do.	156	13,950	7	7
95	Milwaukee, Wis.	12	208	1912	do.	108	5	23	0	10	2	200	4	5	12" steam whistle.	El. inc.	1,457	74,358	10	7
98	Relief	12	195	1915	do.	101	0	23	6	11	5	100	4	2	First-class air siren b.	do.	1,970	87,025	6	7
103	Relief	12	210	1920	do.	95	5	24	0	11	9	175	4	5	10" steam whistle.	Acet.	892	161,074	0	16
67	Umatilla Reef, Wash.	17	450	1897	Comp.	122	7	28	6	13	0	200	4	11	12" steam whistle b.	Oil.	875	69,750	9	27
88	Columbia River, Oreg.	17	1683	1907	Steel.	135	5	29	0	13	0	325	4	11	do b.	do.	402	90,000	11	5
92	Relief	17	1682	1908	do.	135	5	29	0	13	0	400	2	5	do b.	do.	1,183	107,213	6	13
93	Samsure Bank, Wash.	17	1685	1908	do.	135	5	29	0	13	0	400	4	11	do b.	do.	1,600	107,213	9	0
70	San Francisco, Calif.	18	1590	1897	Comp.	122	10	28	6	13	0	349	4	11	do b.	El. inc.	2,944	79,000	8	11
76	Relief	18	1578	1904	Steel.	129	6	28	8	12	0	350	2	5	do b.	Oil.	2,452	90,000	7	0
83	Bluffs Reef, Calif.	18	1668	1904	do.	129	0	28	6	13	0	350	4	11	do b.	do.	5,321	90,000	8	19

⊙ Equipped with radio.
 ⊙ Submarine bell.
 † Displacement (salt water).
 ‡ Displacement (fresh water).
 † Length between perpendiculars.
 ‡ Sail.
 † No means of propulsion.
 ‡ Wood sheathed.
 † Laid up; condemned.
 ‡ Laid up; condemned; station marked by Canadian Government.
 † Placed in commission July 21, 1921.

TENDERS OF LIGHTHOUSE SERVICE IN COMMISSION DURING THE FISCAL YEAR 1929.

Name	District	Displacement		When built	Description	Material of hull	Dimensions			Mean draft		Indicated horsepower	Regular complement		Coal consumed for all purposes	Cost of repairs	Cost of maintenance	Original cost
		Tons	Net				Length overall	Breadth	Depth	Light	Loaded		Officers	Crew				
Hubert	1	818	1,081	1898	Steamer, twin screw	Steel	190	30	16	11 0	13 3	1,000	7	27	1,900	\$9,268	\$90,190	\$184,643
Zebra	1	575	411	1888	do	Iron	151	27	12	8 9	9 6	650	6	22	1,280	8,282	70,205	48,739
Amesbury	2	818	1,081	1908	do	Steel	190	30	16	11 0	13 0	1,000	7	26	1,765	2,532	76,571	191,999
Azalea	2	930	516	1891	Steamer, single screw	do	154	25	12	6 6	9 0	400	6	22	801	2,227	60,239	79,792
Mayflower	2	650	648	1897	Steamer, twin screw	do	161	30	12	7 9	8 1	650	6	24	1,324	5,877	71,045	74,872
Shrub	2	362	435	1912	Steamer, single screw	Wood	103	29	13	6 5	6 9	300	2	13	428	14,259	32,792	
Denise	3	61	84	1892	do	do	80	14	5	4 0	5 0	60	2	5	94	1,554	11,218	6,500
John Rodgers	3	455	371	1883	Steamer, side wheel	Iron	160	27	9	6 6	7 9	290	4	17	748	1,449	36,104	59,987
Larkspur	3	738	888	1909	Steamer, twin screw	Steel	169	30	14	9 1	10 6	750	7	25	1,651	2,872	60,504	123,259
Mistletoe	3	455	476	1872	Steamer, side wheel	Wood	160	26	9	6 9	7 0	370	4	16	540	1,718	32,700	45,833
Pansy	3	441	434	1878	Steamer, twin screw	Iron	132	25	11	7 7	7 11	250	4	17	853	4,275	30,843	48,730
Tulip	3	774	1,142	1908	do	Steel	190	30	16	10 7	13 9	1,000	7	27	1,817	9,664	61,548	191,658
Myrtle	3	455	512	1872	Steamer, single screw	Wood	140	25	11	9 6	11 0	225	4	16	806	5,120	37,630	44,500
Elm	3	259	318	1915	Oil, single screw	do	101	30	9	5 6	6 9	150	2	4	215	1,283	15,717	91,638
Pine	3	55	55	1918	Gasoline, single screw	do	61	15	6	4 3	4 4	50	2	3	2,794	1,596	9,450	16,187
Iris	4	519	606	1897	Steamer, single screw	Steel	153	30	10	8 7	9 6	800	5	20	833	25,645	52,315	84,407
Woodbine	4	85	107	1913	Gasoline, single screw	Wood	95	16	7	5 2	5 11	125	2	5	213,119	323	16,840	24,728
Columbine	5	429	643	1892	Steamer, single screw	Steel	155	27	15	9 6	12 3	800	7	24	1,412	62,493	69,531	58,238
Arbutus	5	398	545	1879	Steamer, twin screw	Wood	153	25	11	7 1	9 0	360	7	23	558	19,636	52,489	49,769
Holly	5	431	499	1881	Steamer, side wheel	Comp	176	24	10	7 0	8 6	400	5	18	5,769	13,371	42,014	41,911
Jessamine	5	369	403	1881	do	Iron	156	24	10	7 3	7 9	350	4	19	5,988	810	39,437	41,911
Juniper	5	125	146	1903	Steamer, twin screw	Steel	95	18	8	4 6	5 0	200	4	8	7,307	2,215	27,283	29,425
Laurel	5	218	209	1915	Steamer, single screw	Wood	105	22	9	6 1	6 10	160	4	12	10,293	1,365	32,888	55,502
Maple	5	567	709	1893	Steamer, twin screw	Steel	164	30	12	7 3	9 5	650	7	24	1,233	12,012	64,445	93,889
Orchid	5	818	1,081	1908	do	do	190	30	16	11 0	13 3	1,000	7	28	1,891	8,354	80,378	186,151

TENDERS IN COMMISSION.

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Cypress	6	730	1,080	1908	do.	do.	190	30	16	10	9	13	3	1,000	7	28	17,876	2,384	17,509	84,452	191,633
Mangrove	6	606	821	1897	do.	do.	164	30	12	7	4	8	0	550	7	24	9,434	1,598	48,640	65,032	74,998
Palmetto	6	156	170	1917	Gasoline, twin screw	do.	90	22	8	3	8	4	0	150	4	8	3,816	39,973	3,447	23,934	27,687
Water Lily	6	29	39	1895	do.	Wood	64	11	5	2	11	3	8	36	2	3	3,520	2,200	36	9,691	9,251
Ivy	7	736	916	1904	Steamer, twin screw	Steel	173	30	13	8	5	9	6	700	7	24	5,992	1,114	3,696	74,785	123,890
Snowdrop	7	30	41	1896	Gasoline, twin screw	Wood	69	11	5	2	10	3	7	32	2	2	4,151	3,855	926	9,798	9,700
Pansy	7	27	31	1915	Gasoline, single screw	do.	50	16	6	2	5	2	9	50	2	2	3,498	34,618	1,816	9,572	
Camellia	8	256	377	1911	Steamer, twin screw	Steel	117	24	10	5	10	7	7	280	4	17	2,895	577	12,127	38,962	57,412
Madonna	8	685	877	1904	do.	do.	173	30	13	7	6	9	2	700	7	25	8,607	1,892	8,996	75,983	124,874
Sunflower	8	806	1,246	1917	do.	do.	174	31	15	9	8	12	2	900	7	27	7,906	1,644	3,318	79,157	124,958
Cosmos	8	57	61	1909	Gasoline, twin screw	Wood	75	15	6	3	9	4	0	160	2	3	5,749	39,841	1,845	11,600	
Lilac	9	542	582	1892	Steamer, single screw	Steel	155	27	15	11	0	11	6	800	6	20	6,228	657	10,760	63,784	92,125
Crocus	10	681	1,035	1904	Steamer, twin screw	do.	165	29	14	9	6	12	3	700	5	23	8,625	1,529	2,655	59,967	119,718
Amaranth	11	537	975	1892	Steamer, single screw	do.	166	28	14	8	6	12	6	672	5	20	8,609	1,120	10,424	51,285	74,994
Aspen	11	555	115	1906	do.	do.	126	25	12	7	3	8	3	440	4	10	5,987	698	2,760	28,939	70,573
Clay	11	416	205	1899	do.	Wood	93	22	7	5	4	6	4	140	4	8	8,427	440	3,175	24,697	
Margold	11	477	696	1890	do.	Iron	160	27	12	8	5	11	0	550	6	20	7,906	999	5,443	49,719	94,871
Hyacinth	12	423	914	1903	do.	Steel	165	28	14	7	0	11	6	768	6	20	8,389	1,609	6,829	58,376	115,000
Sunma	12	660	187	1903	Steamer, twin screw	do.	169	30	13	8	10	11	9	700	6	23	10,064	1,724	4,163	62,497	114,992
Dandelion	13	232	302	1897	Steamer, stern wheel	Wood	140	31	5	2	6	3	3	500	4	15	5,910	1,121	3,076	29,947	23,174
Goldenrod	14	494	283	1888	do.	Steel	169	27	4	2	5	3	4	152	2	12	5,601	708	463	25,031	33,221
Oleander	15	463	548	1901	do.	do.	189	34	7	3	10	4	6	600	4	17	12,307	2,306	2,679	48,084	60,000
Fern	16	245	317	1915	Steamer, single screw	Wood	112	22	10	7	1	8	6	300	5	11	12,003	2,727	1,091	39,506	62,100
Chest	16	1,345	1,970	1917	do.	Steel	201	36	18	9	6	14	0	1,150	8	25	24,246	512,754	6,398	115,857	248,189
Heather	17	631	841	1902	do.	do.	179	28	15	9	6	11	6	685	7	20	9,913	1,820	2,292	67,714	118,568
Marigold	17	774	1,000	1908	Steamer, twin screw	do.	190	30	16	10	7	12	7	1,000	7	24	8,661	2,011	4,470	79,753	211,817
Rose	17	595	567	1916	do.	do.	127	24	11	7	0	9	4	330	5	16	9,200	3,583	4,599	59,100	92,135
Madame	18	654	806	1885	Steamer, single screw	Iron	180	27	15	9	9	11	6	750	7	21	7,350	1,105	5,498	66,943	87,872
Sepia	18	869	1,100	1908	Steamer, twin screw	Steel	190	30	16	10	11	13	5	1,000	7	24	10,988	1,460	10,648	69,698	213,499
Kink	19	838	935	1908	do.	do.	190	30	16	11	2	12	0	1,000	7	24	5,564	1,007	4,762	72,521	213,881

Equipped with radio.

1 Light without cargo and deck loads, and a minimum supply of stores, provisions, water, and coal or oil.

2 Loaded with bunkers or fuel-oil tanks full, all tanks, including trimming tanks, full; full stores and provisions, and an average maximum cargo and deck load.

3 Gasoline.

4 Displacement (fresh water).

5 Barrels of fuel oil. 1 barrel = 42 gallons.

6 Gallons, keel set.

7 Laid up May 20, 1921.

DESCRIPTION OF VESSELS COMPLETED.

LIGHT VESSEL "No. 99."—*Purpose.*—Light Vessel No. 99 was completed and proceeded to the eleventh district, where it is to be permanently assigned, and on July 21 was placed on station at Poe Reef, southern entrance to the Straits of Mackinac, Lake Huron, Mich.

Structure.—The vessel is 91 feet 8 inches over all, with a molded beam of 22 feet and a displacement of 215 tons when floating at a mean draft of 9 feet in fresh water. The entire vessel is built of steel. A steel pilot house with chart space is located on the upper deck; one steel tubular lantern mast surmounted by a gallery and rail with a lens lantern secured on top of the masthead.

Illuminating apparatus.—The signal light consists of an acetylene gas burner with flashing device within a lens lantern, gas being supplied through piping from a battery of gas flasks secured in racks on the main deck.

Fog signal apparatus.—This apparatus consists of a 10-inch steam whistle located on the forward side of and above the smokestack. The characteristic blasts are operated by a special design of steam-drive gear, which is controlled by a clockwork mechanism.

Machinery.—The vessel is propelled by a fore-and-aft two-cylinder steam engine of 125 horsepower, with cylinders 12 inches diameter and a common stroke of 12 inches, making 175 revolutions per minute, driving a right-hand cast-iron propeller 5 feet 6 inches in diameter, with a pitch of 6 feet. Steam is furnished by one single-furnace boiler of the Scotch type, using coal for fuel. The vessel is fitted throughout with necessary modern appliances, including a windlass, sanitary system of plumbing, drainage, and fixtures.

Quarters.—The complement of the vessel is four officers and three men. The officers' and crew's quarters, galley, mess rooms, pantries, bathroom, and lamp room are located on the main deck. The oil room, provision, and other storerooms and the galley coal bunker are located on the lower deck forward.

Painting.—The hull is red, with POE in large white letters on each side.

Cost.—This light vessel was constructed under the act of August 24, 1912, appropriating \$130,000. The vessel's hull was built under contract at East Booth Bay, Me., and cost \$61,000. The boiler machinery and outfit was furnished by the Government and installed by the contractor. The total cost of the vessel was \$97,220. The construction commenced June 29, 1916, and when about half completed the vessel was totally destroyed by fire on July 10, 1917. A new vessel was commenced and was fully completed and delivered to the Government on December 8, 1920.

LIGHT VESSEL "No. 103."—*Purpose.*—Light Vessel No. 103 was completed at New York and proceeded to Milwaukee, Wis., in the twelfth district, where it has been assigned as a relief vessel.

Structure.—The vessel is 96 feet 5 inches over all, with a molded beam of 24 feet and a displacement of 310 tons when floating at a mean draft of 9 feet in fresh water. The entire vessel is built of steel. A steel pilot house and gas-tank room is located on the upper deck; one steel tubular lantern mast surmounted by a gallery and rail with a lens lantern secured on top of the masthead.

Illuminating apparatus.—The signal light contained within the lens lantern consists of an acetylene gas burner operated by a flashing device, gas being supplied by a battery of tanks containing compressed acetylene gas and secured in the tank room on the upper deck.

Fog-signal apparatus.—This apparatus consists of a 10-inch steam whistle located on and above the top of the smokestack on the forward side. The characteristic blasts are operated by a specially designed steam driven gear, which is controlled by a clockwork mechanism.

Machinery.—The vessel is propelled by a fore-and-aft two-cylinder steam engine of 175 horsepower, with cylinders 12 inches diameter, each with a common stroke of 14 inches, making 145 revolutions per minute, driving a right-hand cast-iron propeller 5 feet 9 inches diameter, with a pitch of 7 feet 4 inches. Steam is furnished by a two-furnace boiler of the Scotch type, using coal for fuel. The vessel is fitted throughout with all sanitary plumbing, fixtures, and drainage system.

Quarters.—The complement of the vessel is four officers and five men. The officers' and crew's quarters, galley, mess rooms, pantries, lamp room, and bathrooms are located on the main deck. The oil room, provision, and other storerooms, and the galley coal bunker are located on the lower deck forward.

Painting.—The hull is red except for one-third of the vessel's length amidship which is white, with RELIEF in large black letters on each side.

Cost.—This light vessel was constructed under the act of June 12, 1917, which appropriated \$150,000. The vessel was built at Morris Heights, N. Y., at the contract price

of \$147,428. The construction commenced June 5, 1918, and the vessel was delivered to the Government on December 22, 1920.

PROGRESS OF VESSELS UNDER CONSTRUCTION.

Light Vessel "No. 105."—The act of November 4, 1919, appropriated \$450,000 for the construction of a light vessel for Diamond Shoal Light Vessel Station, North Carolina, to replace Light Vessel No. 71, which was sunk by a German submarine on August 6, 1918. Plans and specifications were prepared and bids received for the construction of the vessel. A contract was awarded in the sum of \$396,750. The vessel was approximately 47 per cent complete on June 30, 1921.

Light Vessels "No. 106" to "No. 110."—The act of March 4, 1921, appropriated \$1,000,000 for lighthouse vessels. Plans and specifications were prepared and bids received for the construction of three, four, or five light vessels. The lowest bid received was \$200,000 each for three vessels and \$160,000 for each additional vessel up to and including five, or a total of \$920,000. A contract was awarded and the work has just been started.

Radio equipment for lighthouse vessels.—The act of June 12, 1917, appropriated \$60,000 for installing radio equipment on lighthouse tenders, seven tenders having been previously so equipped. In addition to this appropriation the Navy Department used naval appropriations for the equipment of 16 tenders with radio during the war. In all 28 tenders were equipped with radio at the end of the fiscal year 1921. One tender was equipped during the fiscal year 1921.

Tender "Aster" and barge.—The act of July 1, 1916, appropriated \$20,000 for constructing or purchasing and equipping a small tender and barge for the eighth district, Texas and Louisiana. Plans and specifications were prepared for a suitable tender and bids invited. The bids received exceeded the appropriation and were rejected. The specifications were modified and bids again invited for the hull and engines separately. The lowest bids were accepted—namely, \$14,400 for the hull and \$5,249 for the engines—and contracts awarded.

Tenders "Oak" and "Hawthorn."—The act of November 4, 1919, appropriated \$760,000 for tenders and light vessels. Plans and specifications were prepared and bids received for the construction of two tenders, or one tender and one light vessel. The lowest bids received were \$357,250 for a tender and \$396,750 for a light vessel. Due to urgent need for tenders, contracts were awarded in the total sum of \$714,500 for two tenders. The two tenders were approximately 80 per cent complete June 30, 1921.

DESCRIPTIONS OF IMPORTANT WORKS COMPLETED.

WOODS HOLE DEPOT, LITTLE HARBOR, MASS.

Appropriation July 1, 1916, \$50,000, for improvements at Woods Hole Depot, Massachusetts. The channel leading to the depot, 3,200 by 150 feet, and the basin, 550 by 400 feet, were dredged to a depth of 17 feet; a two-story brick storehouse, 35 by 80 feet, steel frame and concrete floors and roof, was constructed and about 4,000 square feet of concrete platform laid; walls and roof of carpenter shop and roof of old storehouse covered with asbestos shingles; electric lights, electric welding equipment, 10-horsepower motor, circular saw, air-compressing outfit, and grinder were installed in the new storehouse. This work was begun in 1916 and completed in October, 1920, at a total cost of \$49,994.70.

HUNTS POINT LIGHT STATION, NEW YORK.

Appropriation March 4, 1911, \$5,000, for the establishment of a light and fog signal to mark Hunts Point, East River. The structure, consisting of a skeleton steel tower on a steel tank house, rests on a concrete and stone foundation laid in about 6 feet of water off Hunts Point. The illuminating apparatus is a 300-millimeter acetylene lantern with focal plane about 32 feet above high water. The fog-signal apparatus is an electrically driven siren, current for which is obtained from North Brother Island Light Station, $1\frac{1}{2}$ miles distant, through an armored submarine cable. Actual work on this project was delayed in procuring necessary title to the site. Construction started in November, 1916, light was exhibited January 4, 1917, and fog-signal put in commission February 8, 1921. Total cost of the work, \$4,773.26.

AIDS TO NAVIGATION, EAST RIVER, N. Y.

Appropriation June 12, 1917, \$16,000, for improving aids to navigation. The work accomplished consisted in the establishment of one new light, the rebuilding of structures and change of illuminant from oil to acetylene of four existing lights, and the discontinuance of one light and reestablishment at a new location. The new

structures, which are about 22 feet high, are structural steel towers surmounting sheet-steel tank houses. The foundations are concrete blocks supported on mounds of riprap. The illuminant is acetylene, in 200-millimeter lens lanterns. The work was begun in September, 1917, and completed in February, 1921, at a cost of \$15,943.89.

GENERAL LIGHTHOUSE DEPOT, TOMPKINSVILLE, N. Y.

Appropriation "National security and defense": Allotment \$175,000 to improve facilities at the General Lighthouse Depot, which was used as a naval base during the war. The work completed from this allotment includes a plate shop, iron shed, and coal pocket. The plate shop is of reinforced concrete, 120 by 70 feet, with large window areas on all sides provided with steel sash. An inclosed gallery along the north side provides space for the foreman's office and lockers for the workmen. The coal pocket is a reinforced concrete structure 75 feet long, 39 feet wide, and 55 feet high, supported 15 feet above grade on concrete columns. The interior is divided into separate bins for the various kinds of coal, which is discharged through steel chutes into small cars in the adjoining power house and conveyed directly to the boilers. A structural steel hoisting tower, equipped with modern conveying apparatus is located on the bulkhead wharf immediately in front of the pocket and is connected thereto by a platform 45 feet above the wharf, across which the coal is conveyed by an automatically operated car from the grab bucket to the various bins. The upper part of the tower is covered with asbestos sheathing to provide shelter for the operator and hoister. The work was started in November, 1918, and completed in April, 1921, at a cost of \$165,439.31.

EXECUTION ROCKS LIGHT STATION, N. Y.

Appropriation July 19, 1919, \$10,000, for repairing damage to station by fire, which completely destroyed the fog-signal building and apparatus and the oil house and damaged the tower and dwelling. The tower and dwelling were repaired, a cement-plastered tile fog-signal building constructed, three fuel-oil tanks provided, and new fog-signal apparatus installed. This apparatus is in duplicate, each unit consisting of an oil engine-driven air compressor of 160 cubic feet capacity, automatic siren, and characteristic mechanism. The work was begun in June, 1920, and completed in June, 1921, at a cost of \$9,860.18.

SOUTH PASS JETTY LIGHTS AND FOG-SIGNAL STATION, LA.

Appropriation March 6, 1920, \$125,000, for repairing and rebuilding aids to navigation, seventh and eighth lighthouse districts, damaged or destroyed by hurricane. Under this appropriation a keeper's dwelling and boathouse has been completed. The site is on the west bank of the Mississippi River near the South Pass West Jetty Light and Fog Signal Station. The dwelling is a six-room frame structure, 32 by 37 feet, with asbestos-shingle roof, supported on heavy caps and stringers on 20 creosoted pine piles, well braced diagonally and horizontally. A gallery surrounds the dwelling on three sides. Water is supplied from a 10-foot diameter cistern supported on piles. A 6-foot elevated walk connects the dwelling with the landing at the river and with the light and fog signal building. The boathouse is of frame construction, 17 by 23 feet, supported on piles. Work was started in December, 1920, and completed in May, 1921. Total cost, \$10,976.20.

POINT BORINQUEN LIGHT STATION, P. R.

Appropriation June 12, 1917, \$85,000, for rebuilding station. The old station is located at the foot of a bluff 230 feet high, which obscured the light in a northeasterly direction, while to southward plantations of trees obscured it in the direction of Aguadilla Harbor. The added importance of this station as a landfall light on the opening of the Panama Canal, its former inefficiency and deterioration from erosion and earthquake necessitated rebuilding on a more suitable site. The new location is about 1 mile northeast of the old site on a prominent elevation on the northwest coast of the island, about 233 feet above sea level.

The light tower is reinforced concrete, cylindrical in form, of simple and heavy design, well reinforced to offer maximum resistance to earthquake shocks. The concrete foundation is 25 feet square by 6 feet deep and the main tower walls 15 feet in diameter, 15 inches thick, and 46 feet high, above which is a service room and standard 8-foot helical bar lantern. A cast-iron spiral stairway leads from the base to the service room. The illuminating apparatus consists of a third-order 12-panel flashing lens on

a mercury float and 55-millimeter type A incandescent oil vapor lamp. The light shows a group of four white flashes of 32,000 candlepower every 30 seconds, and is visible 24 miles.

The dwelling, also of reinforced concrete, is a single-story, 40 feet wide by 56 feet long, with 17-foot height ceiling, and is divided by a central hall into two apartments of five rooms each. A rain-water cistern, below grade, extends across the western side of the dwelling. The grounds, about 2 acres in area, are inclosed by a fence of concrete posts and barbed wire. The work was started in October, 1918, and completed September, 1920, at a cost of \$70,492.87.

AIDS TO NAVIGATION, GUANTANAMO BAY, CUBA.

Appropriation July 1, 1918, \$14,000, for improvements to lighting and dwelling for keepers. The former range lights marking the entrance to the harbor were entirely inadequate and improvements much needed, especially by the United States Navy during the annual winter maneuvers. The keepers have been living in temporary quarters since 1898, when the former quarters at Windward Point Light Station were destroyed during an insurrection. The range light structures at Hicacal Beach and Fishermans Point were rebuilt and electric lights installed and a new dwelling constructed at Windward Point Light Station. The light structures for both ranges are steel towers, the front towers being supported on small concrete houses.

The illuminating apparatus for each light is a 200-millimeter lens lantern and electric incandescent lamp supplied with alternating current from the naval station. A submarine cable across the bay carries current from Fishermans Point Light to the Hicacal Beach Lights, which are controlled from the former station. The latter are flashing white, of 750 candlepower. Fishermans Point lights are both red, of 220 candlepower, the front flashing and the rear fixed. The dwelling at Windward Point is a frame structure with stucco exterior and asbestos-shingle roof, on a reinforced pier and beam foundation. A concrete cistern under the foundation supplies the water. The dwelling provides quarters for two keepers. Work was begun in November, 1919, and completed in May, 1921, at a cost of \$12,909.79.

DWELLING, PORT SAN JUAN LIGHT STATION, P. R.

Appropriation July 19, 1919; allotment \$5,000 for keeper's dwelling. This dwelling is a single-story frame structure, 52 by 24 feet, on reinforced concrete beam and pier foundation. The outside finish is stucco on metal lath, and the roof covering is slate-surfaced roofing felt. Quarters are provided for two keepers. Work was begun in June and completed in October, 1920, at a cost of \$4,812.63.

KEWEENAW WATERWAY, MICH.

Appropriation June 12, 1917, \$105,000, for improving aids at Portage Entry and Portage River, at the southeasterly end of Keweenaw Waterway, a navigable channel 25 miles long across Keweenaw Point, Lake Superior, Mich. The former system of aids were inadequate, owing to extensive improvements to this important waterway by the United States Army Engineers. The new project included the construction of a light and fog signal station at the extremity of Portage Entry Breakwater, discontinuance of the old Portage River Lighthouse, rebuilding 11 and constructing 2 new minor light structures inside the harbor and along Portage River, also the construction of a power house and quarters for three keepers on shore and laying of electric transmission lines.

The main light and fog signal structure, located at the extreme end of the breakwater, is an octagonal tower of structural steel, about 14 feet in diameter and 30 feet high, surmounting a reinforced concrete building 28 feet square and 16 feet high, which forms the first story. The foundation is a stone-filled heavy timber crib, 32 by 50 feet, resting on piles cut off at lake bottom level and extending to about water level and capped with a solid block of concrete 8 feet thick. One-half inch steel plates protect the sides of this block from ice damage. On top of this subbase a concrete pier 35 feet square and 11 feet high was constructed, with vaulted interior for storage space. The top of this pier is heavily reinforced to support the tower proper, on the top of which is a standard fourth-order helical bar lantern. The focal plane of the lantern is 68 feet above lake level. The minor light structures are steel towers on concrete block foundations.

The power house is pressed brick, the foundation of concrete, and the roof covered with asbestos shingles. The basement contains a cooling tank for the compressed-air line, water pumping plant, coal-storage space, and a well for circulating water for the

fog-signal engines. On the main floor there is installed two air compressors, two electric generating units, four electric flashers, switchboard, and auxiliary apparatus.

The illuminating apparatus at the main light is a fourth-order fixed lens provided with a 200-watt incandescent lamp and a device for placing a spare lamp in operation in case of the failure of the lamp in service. Current is obtained through a cable from the power house. The light is occulting white, of approximately 6,500 candlepower. The illuminating apparatus for the minor lights consists of incandescent lamps in post lanterns, each provided with a lamp replacement mechanism for substituting a spare light in case of failure of lamp in use and also an annunciator system, which indicates at the power house the location of any such failure. Current for the minor lights is carried on a transmission line from the power house. Overhead, underground, and submarine conductors are used as local conditions require. The generators are of 5-kilowatt capacity, direct connected to 10-horsepower oil engines.

The fog-signal outfit comprises a 6-inch automatic siren, electrically operated, valve and storage tanks installed in the main light and fog-signal building, and duplicate oil engine-driven air compressors and sign flasher for controlling the siren valve, installed in the power house, which is located at the shore end of the breakwater about 3,500 feet from the light station. Compressed air for the siren is delivered from the compressors to the siren through a 2½-inch pipe line. Special means are employed to thoroughly dry the air before it enters the pipe line to avoid trouble from freezing.

No difficulty of this kind has been experienced nor does there appear to be an undue loss of pressure in the line. This entire fog-signal installation has operated thus far with complete satisfaction.

For the proper operation of this system of aids the services of four keepers are required. The structure of the discontinued Portage Entry has been retained as quarters for one assistant keeper, a former dwelling has been remodeled to provide quarters for two keepers, and a new dwelling constructed. The new dwelling contains six rooms and basement. The lower story is brick and the upper story is shingled. Heating plants and plumbing facilities have been provided for all three dwellings. Practically the entire work of construction was carried out by hired labor, utilizing the field equipment of the district, this having been considered the most practical and economical method. Work was begun in January, 1918, and completed in October, 1920, at a cost of \$104,874.70.

AIDS TO NAVIGATION, FIGHTING ISLAND CHANNEL, DETROIT RIVER.

Appropriations, July 1, 1916, \$25,000, for aids to navigation. The straightening of this channel, which constitutes a portion of the improvements under way in the Detroit River by the United States Army Engineers, necessitated a rearrangement of the lighting system. The four ranges required to mark the former crooked course, and formerly attended by keepers, were replaced by single unattended acetylene lights, an additional acetylene light established at the northern and southern ends of the channel, and four gas buoys established at intermediate points.

The structure for the south light is an old wrought-iron skeleton tower intended for use as a day mark on the Atlantic coast, reconstructed to support an acetylene light 32 feet above the water and a set of acetylene tanks. It is supported by four large circular disks jettied to a firm foundation in the river bed. The structure for the north light is a heavy concrete-filled timber caisson supported on piles, some of which are cut off at bottom level, the remainder extending up through the concrete to the top of the caisson, which is 2 feet below water level. The concrete extends 10 feet above this line and supports a brick house 12 feet square, carrying a mast on the top of which is set a 200-millimeter acetylene lantern at a height of 36 feet above water.

At Grosse Isle an acetylene light in a fifth-order lens was installed in the old frame tower. At Mamajuda, Grassy Island, and Ecorse the old structures were removed and 200-millimeter acetylene lights established on 25-foot structural steel towers on steel tank houses with concrete foundations. The entire system is nonattended, but is under the observation of a keeper in the locality, whose duty it is to keep the aids in a serviceable condition. The work was begun in the fall of 1916 and completed in June, 1921, at a cost of \$24,916.16.

AIDS TO NAVIGATION, ALASKA.

Appropriation, June 12, 1917, \$60,000; June 19, 1919, \$75,000, to continue the work of establishing efficient aids to navigation in Alaska. During the fiscal year seven acetylene lights, two gas and bell buoys, and one gas and whistle buoy were established at various points in Alaskan waters. Data relative to these aids, excepting the buoys, is shown in tabular form on the following page. Total amount expended to June 30, 1921, from both appropriations, specified, \$101,475.98.

Name of light.	Locality.	Structure.	Illuminating apparatus.	Characteristic.	Intensity of light in candles.	Focal plane above mean high water, in feet.	Miles seen.	Approximate cost.	Date of establishment.
Elizabeth Island Spit Light.	Cook Inlet.....	White wood house on skeleton structure.	200-millimeter acetylene lantern.	Flashing white (flash 1 sec., eclipse 9 secs.).	130	40	9	\$1,517	July 13, 1920
Pearl Island.....	do.....	White wood house.....	do.....	Flashing white (flash 0.3 sec., eclipse 2.7 secs.).	130	80	9	1,903	July 16, 1920
Port Nellie Juan.....	Prince William Sound.	do.....	do.....	Flashing white (flash 1 sec., eclipse 9 secs.).	130	23	9	1,864	Aug. 28, 1920
Priest Rock.....	Unalaska Island	White cylindrical house on concrete base.	375-millimeter acetylene lantern.	Flashing white (flash 2 secs., eclipse 18 secs.).	310	32	11	3,054	Aug. 2, 1920
Althorp Rock.....	Cross Sound.....	White wood house.....	150-millimeter acetylene lantern.	Flashing white (flash 0.6 sec., eclipse 5.4 secs.).	10	18	4	571	Sept. 15, 1920
Middle Ground Shoal gas and bell buoy.	Prince William Sound.	Red; cylindrical; skeleton superstructure.	200-millimeter acetylene lantern.	Flashing white (flash 0.6 sec., eclipse 5.4 secs.).	130	12	8	4,442	Sept. 13, 1920
Helm Rock gas and whistle buoy.	Sumner Strait....	Red and black; cylindrical skeleton superstructure.	do.....	Flashing white (flash 0.3 sec., eclipse 2.7 secs.).	130	16	8	6,025	Feb. 15, 1921
Wrangell Strait gas and bell buoy.	Wrangell Strait....	Red; cylindrical; skeleton superstructure.	do.....	Flashing white (flash 0.6 sec., eclipse 5.4 sec.).	130	12	8	1,480	Feb. 4, 1921
Channel Rock.....	Sitka Sound.....	White wooden house on square skeleton structure on concrete base.	150-millimeter acetylene lantern.	Flashing white (flash 0.3 sec., eclipse 2.7 sec.).	10	25	4	1,503	June 10, 1921
Cape Edgecumbe.....	do.....	White wooden house.....	375-millimeter acetylene lantern.	do.....	310	100	11	2,520	June 11, 1921

NOTE.—The total appropriations made for the foregoing items of completed special works amounts to \$690,000, and the total expenditures made therefrom to June 30, 1921, amount to \$576,470.

PROGRESS OF SPECIAL WORKS OF CONSTRUCTION.

[For projects on which no important progress has been made during the fiscal year reference is given to the latest Annual Report containing information as to status.]

SECOND DISTRICT.

Woods Hole Lighthouse Depot, Massachusetts.—Project completed; for description see page 45.

Nantucket Harbor Fog Signal, Massachusetts.—See Annual Report, 1920, page 44.

Lighthouse Depot, Chelsea, Mass.—Appropriation July 1, 1918, \$85,000. Site acquired June 4, 1917, by transfer from Treasury Department. The following structures have been completed: Three-story brick and concrete storehouse, 35 by 80 feet, timber wharf, brick oil house 25 by 52 feet, and 800 feet of buoy skids on concrete piers. The site has been filled in to an average depth of 16 inches, a gasoline tank and measuring pump installed, and bids invited for constructing a wharf along the easterly slip. Light keeper's dwellings: See Annual Report, 1920, page 44.

THIRD DISTRICT.

Aids to navigation, Hudson River, N. Y.—See Annual Report, 1920, page 44. During the past year one new light has been established.

Great Salt Pond Light Station, Rhode Island.—See Annual Report, 1920, page 44.

Staten Island Lighthouse Depot, New York.—Wharves: See Annual Report, 1920, page 44. Work on bulkhead wharf now under way. Plate shop and coal shed: Work completed; for description see page 46. Enlarging machine shop: See Annual Report, 1920, page 45.

Execution Rocks Light Station, New York.—Work completed; for description see page 46.

Hunts Point Light and Fog Signal Station, New York.—This project has been completed; for description see page 45.

Aids to Navigation, East River, N. Y.—Project completed; for description see page 45. Riprap protection for light stations: See Annual Report, 1920, page 45. The placing of riprap at Colchester Light Station has been completed.

FOURTH DISTRICT.

Joe Flogger Shoal, Delaware.—See Annual Report, 1920, page 45.

FIFTH DISTRICT.

Repairing and rebuilding aids to navigation, Atlantic coast.—Appropriations March 28, 1918, \$150,000; November 16, 1918, \$300,000, from which \$100,000 and \$284,000, respectively, were allotted to the fifth district. The restoration of light stations damaged by ice floes during the winter of 1917-18 was continued during the past fiscal year as follows: At Thomas Point Shoal, York Spit, and Cobb Point Bar Light Stations repairs were made to metal substructures. At Maryland Point Light Station 1,000 tons of riprap were deposited to form an ice breaker to protect the station from further damage by ice floes.

The structure from Cherrystone Inlet unused lighthouse was moved to the site of the Choptank River Light Station, where it was reerected to take the place of the former structure carried away by ice. The light was reestablished June 9, 1921. At Windmill Point Light Station the piles and braces, which were broken by ice, were repaired by electric welding. At Old Plantation Flats Light Station a new foundation of reinforced concrete and riprap is being constructed. At Bowlers Rock Light an acetylene light and automatic fog bell operated by carbon dioxide gas have been established on a caisson structure, to replace the iron pile lighthouse destroyed by ice.

Aids to navigation, Chesapeake Bay, Md. and Va.—Appropriation June 12, 1917, \$29,000, for aids to navigation on the Eastern Shore of Chesapeake Bay and tributaries. Type S gas buoys have been established at Locus Point, Black Walnut Shoal, Kent Island Spit, and Tilghmans Point. A bell buoy has been placed at Sinepuxent Bay Inlet, and four tall type cone buoys purchased for Occohannock Creek. Slatted three-pile structures have been built for Haines Point Light and Monie Beacon, in Tangier Sound.

Gas buoys, fifth lighthouse district.—Appropriation July 1 and November 4, 1918, \$125,000. Five large gas and whistling buoys, 3 type D, and 18 type L gas and bell buoys, 9 additional buoy lanterns, and miscellaneous buoy equipment were purchased through the general depot. Delivery has been made of all except 5 type L gas and bell buoys.

SIXTH DISTRICT.

St. Johns River, Fla.—Appropriation July 1, 1916, \$66,000, for improving aids between Jacksonville and the sea. Fourteen minor lights have been established, three range lights changed from oil to acetylene, one additional acetylene light established, two range lights improved, four gas lighted buoys established, and one lighted buoy replaced by a larger type, four unlighted buoys established, and four replaced by larger types. Fourteen light structures have been rebuilt, improved day-marks provided for all range structures, and three unlighted beacons established.

SEVENTH DISTRICT.

Florida Reefs, Fla.—Appropriation July 1, 1916, \$75,000, for establishing additional aids and repairing and improving existing aids. A portion of the illuminating apparatus has been purchased and the metal work for light structures at Molasses and Pacific Reefs has been delivered at Key West, Fla., and work of erection is under way. Probable date of completion, December, 1921.

Dwelling, Dry Tortugas Light Station.—See Annual Report, 1920, page 47.

Repairing and rebuilding aids to navigation, seventh and eighth lighthouse districts.—See Annual Report, 1920, page 47. During the past fiscal year the following work has been completed: Tender Ivy, repairs to stern quarter completed; Key West Lighthouse reservation, repairs to dwellings; Rebecca Shoal Light Station, repairs to structure; Dry Tortugas Light Station, repairs to dwellings. Plans and specifications were prepared for new structures to replace those destroyed on Florida Reefs and Hawk Channel. Buoy appendages were delivered at the depot.

EIGHTH DISTRICT.

Aids to navigation, Atchafalaya Entrance Channel, La.—Work completed: see Annual Report, 1916, page 88. One gas and bell buoy purchased during past fiscal year.

Aids to navigation, Mississippi River, La.—See Annual Report, 1920, page 47. During the past fiscal year one light was changed from oil to acetylene.

Galveston Jetty Light Station, Tex.—Appropriation March 4, 1921, \$6,500, for fog signal. Bids have been invited for fog signal machinery, etc. Light keepers' dwellings: See Annual Report, 1920, page 47. All materials for constructing a dwelling at South Pass Range Rear Light Station have been delivered at Port Eads Depot.

Repairing and rebuilding aids to navigation.—See Annual Reports, 1917-1920. During the past fiscal year this work has been carried on under the several appropriations provided therefor as follows:

Appropriation February 28, 1916, \$200,000: Established fog bell and post lantern light at Bayou Villars Light Station; purchased piles and timber for Galveston Depot.

Appropriation September 8, 1916, \$125,000; allotment, \$122,200: Materials purchased for Galveston Depot.

Appropriation March 28, 1918, \$100,000: Pass A Loutre Light Station, dwelling raised and placed on concrete piers, boathouse and sidewalk rebuilt, dwellings and outbuildings repaired, and new door cut in tower; South Pass Jetty Lights, rebuilt sidewalks; South Pass Rear Range Light Station, rebuilt breakwater and sidewalks; Barataria Bay Light Station, bids invited for materials for 700 feet of sidewalk.

Appropriation March 6, 1920, \$125,000; allotment, \$70,000: Brazos River Light Station, rebuilt fence and walk, repaired cistern, foundations, gutters, and outbuildings; Halfmoon Reef Light Station, renewed one side of dwelling, also gutters, cistern, etc.; Houston Channel Entrance Range Lights, placed riprap protection around lights; Sabine Bank Light Station, renewed cast-iron plates, railings, and stanchions, placed reinforced concrete wall inside of plates, installed new ladders, and made minor repairs; South Pass East Jetty Light Station, repaired foundation and walks; South Pass Jetty Lights and Fog Signal Station, built new dwelling (see description on page 46); Texas City Channel Cut A Range Lights, placed riprap protection around lights.

At the close of the fiscal year work was in progress at the following stations: Aransas Pass, Corpus Christi, Matagorda, and Lights Nos. 1, 3, 5, 7, 9, 11, and 13, in Turtle Cove Channel.

Sabine Jetty Light Station, Louisiana.—See Annual Report, 1920, page 49.

Sand Island Light Station, Alabama.—See Annual Report, 1920, page 49.

NINTH DISTRICT.

Point Borinquen Light Station, Porto Rico.—Work completed; for description see page 46.

Point Jiguero Light Station, Porto Rico.—Appropriation July 19, 1919, \$24,000, for rebuilding station. This work is being done by hired labor and purchase of material

under direction of the district force, as all bids received were in excess of the appropriation. A dwelling for two keepers has been completed and materials for a reinforced concrete tower are being assembled.

Port San Juan Light Station, Porto Rico.—Dwelling completed; for description see page 47.

TENTH DISTRICT.

Conneaut Harbor, Ohio.—Appropriation July 1, 1916, and deficiency appropriation for fiscal years 1920 and 1921, total \$90,100, for light and fog signal station. The structure has been completed with the exception of the finished floors and minor interior details. Illuminating apparatus installed and light placed in commission September 15, 1920. Bids on fog-signal apparatus have been received.

Fairport Harbor, Ohio.—Appropriation June 12, 1917, for improving aids to navigation. Foundation completed and steel structure erected; interior work in progress. Owing to increased cost of construction since original estimate, a further appropriation of \$37,000 is necessary to complete this project.

ELEVENTH DISTRICT.

Detroit River, Mich.—See Annual Report, 1920, page 50. Concrete piers for two additional lights are now under construction. Amount expended to June 30, 1921, \$154,826.39.

Aids to navigation, Fighting Island Channel, Detroit River, Mich.—Work completed; for description see page 48.

Keweenaw Waterway, Mich.—Project completed; for description see page 47.

Aids to navigation, St. Marys River, Mich.—See Annual Report, 1920, page 51. During the past fiscal year the work at Pipe Island and Frying Pan Island has been completed, and repairs to structures at Woods Point Range Rear, Johnsons Point, and in West Neebish Channel are under way. Contract let for dredging away old substructures at Lights 1 and 2, West Neebish Channel. One set of range lights will be established in West Neebish Channel if funds are sufficient. Additional appropriation will be necessary to complete this project.

Spectacle Reef Light Station, Mich.—See Annual Report, 1920, page 51. Plans have been approved for a belt of reinforced concrete approximately 2 feet in thickness around the entire pier, extending to a height of 8 feet above water line. This work will be prosecuted vigorously during this summer. It is expected that the appropriation will be insufficient to complete the entire project as planned. These repairs are urgently necessary for the safety of the station, and an additional appropriation will therefore be requested.

Lighthouse Depot, Detroit, Mich.—See Annual Report, 1920, page 51. During the past fiscal year the lamp shop has been completed, but mechanical equipment can not be provided from the present appropriation, which is practically exhausted. An additional appropriation has been requested to complete this project.

TWELFTH DISTRICT.

Chicago Harbor Light Station, Ill.—See Annual Report, 1920, page 52.

Indiana Harbor, Ind.—See Annual Report, 1920, page 52. Progress on this work during the past fiscal year has been made as follows:

East Breakwater Light and Fog Signal Station: Timber crib foundation, 44 by 65 feet, completed in August, 1920, by United States Army Engineers. Cost of this crib was covered by appropriation for harbor works. The concrete subbase for the light station on top of this foundation was completed by contract in September, 1920. The reinforced concrete base for the main structure is now under construction by contract and will probably be completed about the middle of August. A two-story reinforced concrete building will be constructed on this base by hired labor.

East Pier Light: An acetylene light on a 31-foot steel tower with concrete base has been completed and was put in commission June 5, 1920.

West Breakwater Light: Establishment of this light awaits the completion of the easterly end of the west breakwater by the United States Engineers. Amount expended to June 30, 1921, \$16,119.93.

Keepers' dwellings: See Annual Report, 1920, page 53. Negotiations are about completed for a site for a dwelling at Manitowoc, Wis. The dwelling at Poverty Island is about 75 per cent completed.

SIXTEENTH DISTRICT.

Lighthouse Depot, Ketchikan, Alaska.—See Annual Report, 1920, page 53. The concrete work on the storehouse has been completed and the building is nearly finished. This building is now in use for the stocks and stores of the district. The machine

and carpenter shops are also temporarily installed in this building, pending further appropriations for a new shop building. Work has been suspended on this project owing to lack of funds.

Aids to navigation, Alaska.—Appropriations June 12, 1917, \$60,000; June 19, 1919, \$75,000. During the past fiscal year two gas and bell buoys, one gas and whistling buoy, and seven acetylene lights were established. For description see page 48.

SEVENTEENTH DISTRICT.

Aids to navigation, Coquille River, Oreg.—See Annual Report, 1920, page 53.

Aids to navigation, Washington and Oregon.—See Annual Report, 1920, page 53. During the past fiscal year three electrically operated fog bells, six oil post lanterns, one oil float light, two electric range lights, two acetylene lights, one gas and bell buoy, and one concrete beacon were established. One oil post lantern and one electric post lantern remain to be established.

Light keeper's dwelling.—Appropriation July 19, 1919, allotment \$6,500 for dwelling at Yaquina Head Light Station. Bids received were rejected as being excessive. Plans will be modified and new bids asked.

EIGHTEENTH DISTRICT.

Point Vincente, Calif.—See Annual Report, 1920, page 54. Deed to site is now awaiting signature of owners.

NINETEENTH DISTRICT.

Light keeper's dwelling.—Appropriation July 19, 1919, allotment \$5,000 for keeper's dwelling at Diamond Head Light Station. Contract for frame bungalow has been let, and work will be completed about September 1.

NOTE.—The total appropriations made for the foregoing items of special works particularly reported on amount to \$1,647,100.

SUMMARY OF IMPORTANT CONSTRUCTION AND REPAIR WORK UNDER GENERAL APPROPRIATIONS COMPLETED DURING FISCAL YEAR 1921.

FIRST DISTRICT.

Cape Elizabeth Light Station, repairs to dwelling, \$1,050; tender *Hibiscus*, docking and repairs, \$2,810; tender *Zizania*, docking and repairs, \$4,983; light vessel No. 74, docking and repairs, \$2,296.

SECOND DISTRICT.

Canal Channel Upper Range Front Light, renewing riprap foundation, \$2,316; Newburyport Harbor Light Station, repairs to buildings, \$1,122; Rockport Breakwater Light, established, \$1,004.

THIRD DISTRICT.

General Depot (south residence), repaired and painted walls, etc., \$1,170; Block Island North Light Station, repairs to dwellings, etc., \$1,887; Castle Hill Light Station, repaired dwelling, \$1,347; Fort Wadsworth Light Station, general repairs to dwelling, etc., \$1,207; Great Captain Island Light Station, installed storage tanks for fuel, etc., \$1,350; Hog Island Shoal Light Station, repaired station and provided tanks for oil storage, \$1,972; Montauk Point Light Station, installed lens pedestal and clock, \$1,394; New Haven Light Station, established blower siren, \$6,169; Sea Flower Reef Light, established light, \$1,949; Sea Girt Light Station, established tower for radio fog signal, \$1,939; Barnegat Light Station, shore protection, \$11,514; tender *Daisy*, retubed and replaced boiler and other minor repairs, \$1,222; tender *Larkspur*, general minor repairs, etc., \$1,422; tender *Mistletoe*, general repairs, etc., \$1,417; tender *Myrtle*, repairs to boiler and minor repairs to hull and machinery, \$1,836; tender *Pansy*, general repairs to hull and machinery, \$1,808; tender *Tulip*, installed line-throwing gun, searchlights, and made minor repairs, \$3,287; general repairs to superstructure, hull, and machinery, \$2,063; general repairs to vessel, \$3,693; Cornfield Point Light Vessel No. 48, general repairs to hull and machinery, \$1,124; Fire Island Light Vessel No. 68, repaired sheathing metal and made other repairs to hull and machinery, etc., \$1,718; repaired mooring chains, furnished new boat, and minor repairs to hull and machinery \$5,389; Northeast End Light Vessel No. 44, painted bottom, etc., and made minor repairs to hull and machinery, \$2,988; Overfalls Light

Vessel No. 69, repaired damages due to collision; docking and repairs to sheathing metal; minor repairs to hull and machinery, \$3,055; relief Light Vessel No. 16, docking and repairs to hull and machinery, \$1,847; relief Light Vessel No. 78, general repairs, \$4,785.

FOURTH DISTRICT.

Horseshoe Range West Group Rear Light Station, erected steel tower, \$4,013; Schuylkill River Range Lights, two steel towers erected, \$2,431; Harbor of Refuge Light Station, general repairs made to wharf, tower, etc., \$3,661; Broadkill Light, established acetylene light \$1,986; Mahon River Light Station, boardwalk rebuilt, new boat davits installed, and general repairs to wharf, \$1,406; Fenwick Island Light Station, general repairs, \$1,950; tender *Iris*, docking, painting, and general repairs, \$15,100.

FIFTH DISTRICT.

Hog Island Light Station, general repairs to tower, dwellings, and outbuildings, \$6,077; buoyage, converting two type C buoys to burn acetylene gas, \$1,148; Cape Lookout Light Station, general repairs and improvements, \$4,386; Washington Light-house Depot, general repairs and improvements, \$6,200; tender *Orchid*, docking and minor repairs to hull and machinery, \$5,301; tender *Maple*, docking, cleaning, and painting, and minor repairs to hull and machinery, etc., \$9,961; tender *Arbutus*, docking, general repairs, and minor repairs to hull and machinery, \$15,452; tender *Columbine*, docking, painting, and repairs, \$1,640; tender *Holly*, docking, repairing sheathing metal, and minor repairs to hull and machinery, \$11,024; Tail of Horseshoe Light Vessel No. 46, docking, painting, and minor repairs to hull and machinery, \$2,654; Relief Light Vessel No. 49, docking, painting, recalking decks and top sides, \$2,000; Fenwick Island Shoal Light Vessel No. 52, docking, painting, minor repairs to hull and machinery, etc., \$9,565; Diamond Shoal Light Vessel No. 72, docking, painting, and minor repairs to hull and machinery, \$5,767; Cape Lookout Shoals Light Vessel No. 80, docking, painting, new smokestack, minor repairs to hull and machinery, \$4,441; Winter Quarter Shoal Light Vessel No. 91, docking, painting, minor repairs to hull and machinery, \$3,735; district pile driver, docking, refastening, calking, and sheathing, \$4,649.

SIXTH DISTRICT.

Hillsboro Inlet Light Station, general repairs, and improvements to dwellings, \$2,201; tender *Cypress*, docking, repairs to hull, machinery, boiler, etc., \$2,397; tender *Mangrove*, docking and general repairs to hull, machinery, and boilers, \$3,876; tender *Palmetto*, docking and minor repairs, \$1,985; Relief Light Vessel No. 53, docking, minor repairs to hull and machinery, installation of additional fresh-water tanks, \$7,302; Brunswick Light Vessel No. 84, purchased new boiler tubes, \$1,637; Frying Pan Shoals Light Vessel No. 94, purchased new surface condenser for main engine, \$2,821.

SEVENTH DISTRICT.

Dry Tortugas Light Station, provided new motor boat, \$1,247; Egmont Key Depot, general repairs, \$1,488; Gasparilla Island Range Light Station, installed sanitary plumbing system, built concrete wharf, etc., and general repairs, \$7,607; tender *Ivy*, repaired launch and installed new engine, repairs to hull and machinery, \$3,829; Key West Main Ship Channel Range Rear Light, erected iron tower, \$2,897; Miami Harbor lights and beacons, erection of dolphin lights and beacons, and repairs to other aids, \$4,342.

EIGHTH DISTRICT.

Cape St. George Light Station, repairs to wharf, dwelling, and walks, \$2,021; Gulfport Channel Light No. 8, rebuilt structure on pile foundation, \$2,415; Heald Bank Light Vessel No. 81, docking and repairs to hull and machinery, \$4,801; Houston Channel Gas Buoy, 2, established oil gas buoy, \$2,040; Neches River Lights, Nos. 2, 4, 6, 8, and 10, renewed mud sills and ground pegs of each foundation, \$1,380; Port Arthur Canal Light, renewed piles, braces, and decking, \$1,154; Round Island South Spit Light, rebuilt structure, \$1,732; Sabine Pass Inner Range Front Light, renewed piles, braces, and decking, \$1,154; Second Turn Light, installed acetylene light, rebuilt generator house, \$1,106; Ship Shoal Gas and Whistling Buoy, 2, established compressed acetylene gas and whistling buoy, \$4,735; South Pass East Jetty Light Station, constructed crib and mattress breakwater, \$6,352; South Pass Light Vessel No. 102, docking and repairing hull and machinery, \$5,078; tender *Camellia*, docking,

repairs to hull and machinery, installing bilge keels, \$9,852; tender *Magnolia*, docking, repairs to hull, and installing new propellers, \$5,781; Texas City Channel Gas Buoy, 7, established oil gas buoy, \$2,040; Timbalier Light Station, placing filling under station, \$1,099.

NINTH DISTRICT.

Jobos Harbor Light Station, acetylene illuminating apparatus installed, \$1,121; Christiansted Harbor buoys and beacons, changing mooring type buoys to regular navigation type buoys, \$2,420; San Juan Depot, temporary repairs to wharf, \$1,800; Anegado Shoal Range Front Light, installed acetylene equipment, \$1,100.

TENTH DISTRICT.

Tender *Crocus*, docking, cleaning, and painting hull, and minor repairs to stern bearings, etc., \$1,410; small boats—built and equipped three new motor boats at Buffalo Depot, \$5,935; Green Island Light Station, removed sheds and built inclosed veranda, cistern, etc., \$1,030; Oswego Light Station, installed electricity as illuminant, \$1,382; Presque Isle Fog Signal Station, provided new smokestack and repairs, \$1,229.

ELEVENTH DISTRICT.

Tender *Marigold*, installed air pump, heater, service pump, and made other repairs, \$3,700; tender *Amaranth*, new shoe, rudder post, and rudder, \$7,875; Fourteen Mile Point, rebuilt landing dock, \$1,872; Cheboygan River Range, constructed timber sheet-pile revetment for shore protection at front light, \$4,834; Keweenaw Waterway, built boathouse, installed heating plant, relaid cable, etc., \$4,798; Portage Lake Ship Canals, moved fog-signal house and equipment, \$2,585; Sand Island Light Station, changed to acetylene, \$1,123; Portage Lake Ship Canals West Breakwater, modified tower light and changed light to acetylene, \$1,974.

TWELFTH DISTRICT.

Beaver Island Light Station, built new dock and made general repairs, \$7,296; Big Sable Light Station, made general repairs, installed water-supply pump, sewage-disposal plant, and built concrete walks, \$5,999; St. Joseph Pierhead, erected elevated walk, \$2,863; Milwaukee Pierhead, reconstructed superstructure, and installed an insulated water-supply pipe, \$14,567; Milwaukee Depot, constructed heating boiler, enlarged carpenter shop, etc., \$6,839; Menasha Upper Light, constructed superstructure and provided steel rail ice slides and tower, \$1,747; tender *Sumac*, docking and general repairs, \$3,168; tender *Hyacinth*, docking and general repairs, \$6,937.

SIXTEENTH DISTRICT.

Nome Harbor Range Lights, established range lights, \$1,167; tender *Fern*, new cargo boat, \$1,036; tender *Cedar*, docking and repairs, \$3,374.

SEVENTEENTH DISTRICT.

New Dungeness Light Station, constructing wharf, boathouse, and tramway, \$3,231; Mukilteo Light Station, shore protection and repairs to fences, \$1,866; tender *Manzanita*, docking, painting, and repairs to machinery, \$1,115; tender *Heather*, docking and repairs, \$1,467; tender *Rose*, docking and repairs, \$1,289; Columbia River Light Vessel No. 88, docking and repairs, \$1,151; Swiftsure Bank Light Vessel No. 93, docking and repairs, \$2,055.

EIGHTEENTH DISTRICT.

Point Cabrillo Light Station, installed water tank, \$1,031; Humboldt Bay Fog Signal and Lights, riprap protection for bulkheads, \$2,802; Petaluma Creek Light, No. 2, installed acetylene light on wood pile structure, \$2,281; Roe Island Light Station rebuilt bulkheads and wharf, \$3,522; tender *Madrono*, docking and repairs, \$3,700; tender *Sequoia*, docking and repairs, \$3,400; Blunts Reef Light Vessel No. 83, docking and repairs, \$1,600; retubing condenser, \$1,448.

NINETEENTH DISTRICT.

Tender *Kukui*, docking and repairs, \$1,336; Honolulu Lighthouse Depot, repairs to wharf, \$1,466.

**UNEXPENDED BALANCES ON JUNE 30, 1921, FROM APPROPRIATIONS
FOR SPECIAL WORKS.**

District.	Title of appropriation.	Acts.	Balance.
General...	Repairing and rebuilding aids to navigation, Atlantic coast.	Mar 28, 1918; Nov. 4, 1918...	\$75, 189. 46
	Light vessels for general service.....	Aug. 24, 1912; Aug. 26, 1912..	97, 350. 44
	Light vessels for general lake service.....	June 12, 1917.....	629. 78
	Radio installations on lighthouse tenders.....	do.....	21, 198. 23
	Repairing and rebuilding aids to navigation, seventh and eighth lighthouse districts.	Mar. 6, 1920.....	57, 861. 25
	Vessels for Lighthouse Service.....	Nov. 4, 1919; Mar. 4, 1921....	1, 414, 822. 43
	Light-keepers' dwellings.....	July 19, 1919.....	37, 273. 32
2d.....	Nantucket Harbor Fog Signal, Mass.....	Mar. 28, 1918.....	5, 417. 68
	Depot for second lighthouse district.....	July 1, 1918.....	14, 754. 31
3d.....	Aids to navigation, Hudson River, N. Y.....	July 1, 1916.....	944. 45
	Tender for third lighthouse district.....	June 12, 1917.....	149, 822. 29
	Great Salt Pond Light Station, R. I.....	do.....	1, 296. 45
	Staten Island Lighthouse Depot, N. Y. (wharves).	Mar. 28, 1918.....	1, 154. 33
	Staten Island Lighthouse Depot, N. Y. (office and laboratory).	June 12, 1917.....	1, 336. 35
	Staten Island Lighthouse Depot, N. Y. (machine-shop).	July 19, 1919.....	30, 000. 00
	Execution Rocks Light Station, N. Y.....	do.....	3, 255. 46
	Riprap protection for light station, third lighthouse district.	do.....	121, 883. 63
4th.....	Joe Flogger Shoal Light Station, Delaware River..	June 30, 1906; July 1, 1918...	202. 82
5th.....	Cape Charles Light Vessel, Va.....	June 12, 1917.....	129, 900. 38
	Aids to navigation, Chesapeake Bay, Md. and Va..	do.....	23, 142. 04
	Fifth lighthouse district gas buoys.....	July 1, 1918; Nov. 4, 1918...	12, 364. 66
	Diamond Shoal Light Vessel, N. C.....	Nov. 4, 1919.....	314, 124. 22
6th.....	Aids to navigation, St. Johns River, Fla.....	July 1, 1916.....	15, 950. 40
7th.....	Aids to navigation, Florida Reefs, Fla.....	do.....	24, 383. 88
8th.....	Galveston Jetty Light Station, Tex.....	June 11, 1896; May 27, 1908; Mar. 4, 1921.	6, 601. 87
	Sabine Pass Jetty Light Station, Tex.....	May 27, 1908.....	40, 000. 00
	Southwest Pass Light Vessel, Mississippi River...	Oct. 22, 1913.....	12, 746. 85
	Aids to navigation, Atchafalaya Entrance Channel, La.	do.....	1, 892. 64
	Repairing and rebuilding aids to navigation, Gulf of Mexico.	Feb. 28, 1916; Sept. 8, 1916; Mar. 28, 1918.	25, 609. 63
	Aids to navigation, Mississippi River, La.....	July 1, 1916.....	10, 442. 43
	Tender and barge, for eighth lighthouse district...	do.....	19, 960. 97
	Sand Island Light Station, Ala.....	July 1, 1918.....	36, 985. 18
9th.....	Aids to navigation, Guantanamo Bay, Cuba.....	do.....	1, 100. 21
	Point Borinquen Light Station, P. R.....	June 12, 1917.....	14, 547. 96
	Point Jiguero Light Station, P. R.....	July 19, 1919.....	10, 211. 41
10th.....	Aids to navigation, Ashtabula Harbor, Ohio.....	Oct. 22, 1913.....	2, 054. 97
	Aids to navigation, Conneaut Harbor, Ohio.....	July 1, 1916; Nov. 4, 1919; Mar. 1, 1921.	14, 667. 28
	Aids to navigation, Toledo Harbor, Ohio.....	July 1, 1916.....	982. 70
	Aids to navigation, Huron Harbor, Ohio.....	June 12, 1917.....	407. 58
	Aids to navigation, Fairport Harbor, Ohio.....	do.....	9, 610. 66
11th.....	Detroit River Lights, Mich.....	Mar. 4, 1911.....	55, 173. 61
	Aids to navigation, Fighting Island Channel, Detroit River, Mich.	July 1, 1916.....	83. 85
	Sand Hills Light Station, Mich.....	June 12, 1917.....	96. 07
	Aids to navigation, Keweenaw Waterway, Mich..	do.....	125. 30
	Detroit Lighthouse Depot, Mich.....	July 1, 1918.....	791. 30
	Spectacle Reef Light Station, Mich.....	do.....	27, 608. 80
	Aids to navigation, St. Marys River, Mich.....	Nov. 4, 1918.....	19, 371. 72
12th.....	White Shoal Light Station, Lake Michigan.....	Mar. 4, 1907.....	21, 186. 23
	Chicago Harbor Light Station, Ill.....	June 12, 1917; July 19, 1919...	2, 921. 15
	Aids to navigation, Indiana Harbor, Ind.....	June 12, 1917.....	86, 880. 07
16th.....	Aids to navigation, Alaska.....	July 19, 1919.....	33, 524. 02
	Depot for sixteenth lighthouse district.....	July 1, 1918; Mar. 6, 1920...	341. 42
17th.....	Kellett Bluff Light Station, Wash.....	July 1, 1916.....	153. 41
	Aids to navigation, Coquille River, Oreg.....	do.....	5, 959. 66
	Aids to navigation, Washington and Oregon.....	June 12, 1917.....	1, 148. 51
18th.....	Point Vincente Light Station, Calif.....	July 1, 1916.....	79, 986. 50
19th.....	Aids to navigation, Pearl Harbor, Hawaii.....	June 12, 1917.....	33, 493. 50

APPROPRIATIONS CARRIED TO SURPLUS FUND.

The following balances of appropriations for special works in the Lighthouse Service, the objects of which had been accomplished, were covered into the surplus fund in the Treasury June 30, 1921:

Oil houses for light stations.....	\$330. 40
Dog Island Light, Maine.....	381. 46
Cape Cod Canal Lights, Massachusetts.....	94. 91
Woods Hole Lighthouse Depot, Massachusetts.....	5. 30
Aids to Navigation, East River, N. Y.....	56. 11
Staten Island Lighthouse Depot, New York (carpenter shop).....	1, 144. 51
Ambrose Channel Buoys, New York.....	. 07
Hunts Point Light Station, New York.....	226. 74
Aids to Navigation, Delaware River, Pa. and Del.....	63. 20
Thimble Shoal Light Station, Virginia.....	344. 61
Lighting Norfolk Harbor, Va.....	212. 40
Navassa Island Light Station, West Indies.....	3, 991. 61
Aids to Navigation, Lorain Harbor, Ohio.....	25. 46
Manitowoc Breakwater, Light Station, Wisconsin.....	97. 16
Cape St. Elias Light Station, Alaska.....	200. 16

ASSISTANCE RENDERED IN SAVING LIFE AND PROPERTY BY VESSELS OR EMPLOYEES OF THE LIGHTHOUSE SERVICE DURING THE FISCAL YEAR 1921.

The following extracts from reports received by the bureau give some typical cases of especially meritorious service rendered by vessels and employees of the Lighthouse Service in saving life and property during the fiscal year:

Stranded oil tank.—The Standard Oil tank *Atlas*, of 1,145 net tons, with a cargo of gasoline and kerosene, struck a reef and was stranded in Snow Pass, about 75 miles from Ketchikan, Alaska, at about 5 o'clock on the morning of December 20, 1920. It appeared that the master of the oil tank feared the vessel would slide off into deep water at low tide and was preparing to abandon ship. The lighthouse tenders *Cedar* and *Fern*, which were at the lighthouse depot at Ketchikan, were ordered to proceed at once to the assistance of the *Atlas*. The floating of the stranded vessel was accomplished promptly by the two tenders and was carried out with skill and good judgment.

Disabled schooner.—The *Annie E*, a 60-ton schooner which left Honolulu for the island of Hawaii on August 8, 1920, with a cargo of lumber and gasoline, sprung several leaks and became disabled the first day out of Honolulu. Two days later three of the sailors, who had left the vessel in an endeavor to make shore and summon assistance, were picked up by a fishing sampan. Motor launches were sent in search of the schooner, and Navy Department hydroplanes and airplanes also made search, but without success. On August 15 information by wireless was received from the U. S. transport *Madawaska*, which was on its way from Honolulu to Manila, that a sailing vessel showing flareups, but apparently in good condition, was sighted, and gave its location. The lighthouse tender *Kukui*, which was having its boilers repaired, was ordered to get up steam and leave in search of the missing vessel. The tender left Honolulu the same evening, and the next evening at 8 o'clock located the disabled schooner 80 miles westward of the location given by the transport *Madawaska* and about 225 miles from Honolulu. All the members of the crew were rescued by the *Kukui*, but the dilapidated condition of the schooner made it impossible to tow it to port, and it was set afire to prevent its becoming a menace to navigation.

Motor boat in distress.—At 6 o'clock on the morning of March 29, 1921, the keeper of Bakers Island Light Station, Massachusetts, sighted a small open motor boat in distress about 2 miles northeast of the light station. The wind was northwest and very strong, the weather cold and clear. The keeper and assistant keeper went to the assistance of the boat and found two men who were nearly exhausted from cold and hunger, the boat having broken down the preceding evening. The men were taken to the light station, where they were given a hot breakfast by the light keepers.

Grounded steamer.—On the morning of December 17, 1920, at about 10 o'clock, the U. S. Shipping Board steamer *National Bridge*, a vessel of 3,545 tons, was found to be aground on Bald Head Shoal, Cape Fear River Bar, N. C., by the lighthouse tender *Cypress*. A strong southwesterly breeze was blowing. The *Cypress* ran close enough to throw a heaving line on board the disabled steamer, and with a towing line succeeded in pulling her off the shoal into deep water. The captain of the *Cypress* states that the tender arrived just in time to save the *National Bridge*.

Endangered lighthouse.—About 5 o'clock on the morning of December 24, 1920, the keeper of Long Point Shoal Light Station, North Carolina, discovered that a string of 12 or 15 barges had become entangled around the lighthouse, causing violent vibration of the structure. The keeper thought the lighthouse in serious danger, as

the sea was running high, with a strong tide. The keeper stated: "I knew that something had to be done, and that quick, or the lighthouse would soon be torn up. When I descended I found that the barges were connected with a heavy wire cable. I got an ax and managed to cut the cable, and by hard labor and perseverance for quite awhile I got the barges on the weather side freed. It was the worst job I ever tackled in the night, but I believe I saved this house from serious damage, if not wreck, for just after this it blew hard."

Disabled motor boat.—On November 11, 1920, at 11 o'clock in the morning, the lighthouse tender *Mayflower* picked up the disabled motor boat *Alleppo*, of Newburyport, Mass., at a point about 10 miles southeast of Cape Ann Light Station, Massachusetts, with two men aboard, who stated that they had been adrift for two days without food or water. The motor boat was without gasoline, had no sail, and the oars were lost. There was no compass and the men had no idea of their location.

Floating dry dock.—The 8,000-ton floating dry dock owned by the Charleston Dry Dock & Machine Co., of Charleston, S. C., and which had been temporarily removed from its slip and moored during dredging operations, parted its moorings and went adrift during a heavy squall about 11 o'clock on the night of July 2, 1920. The tide was ebbing and the dry dock was beginning to drift out of the harbor, when the lighthouse tender *Mangrove*, which was at the lighthouse depot, was notified and promptly got under way. The tender found the dry dock floating out through Folly Island Channel, a little below Fort Ripley Shoal Light Station, made fast and, assisted by the tugs *Cecelia* and *Manomet*, returned the dry dock to the company's wharf. The loss of the dry dock or its serious damage would have been in the nature of a disaster to the owners, its value being estimated at half a million dollars, and would also be very detrimental to local shipowners, who depend on it for docking their vessels.

Wrecked power boat.—On November 17, 1920, during a heavy windstorm, the power boat *Stroller*, Capt. Langley, was driven upon the dock at the Lazaretto Lighthouse Depot, Maryland, staving in her side. The officers and crew of the lighthouse tender *Maple* assisted in removing from the sinking vessel the wife and three small children of Capt. Langley and afterwards beaching the vessel.

A complete list, in condensed form, of cases of assistance rendered in the saving of life and property by employees and vessels of the Lighthouse Service during the fiscal year, arranged in the order of lighthouse districts, follows:

FIRST DISTRICT.

W. P. Richardson, keeper of Cape Neddick Light Station, Maine, towed disabled rowboat with two men aboard to place of safety.

H. G. Sawyer, keeper of Bear Island Light Station, Maine, towed to port disabled motor launch with one man aboard.

Robert and Raymond Purlington, sons of John E. Purlington, keeper of Nash Island Light Station, Maine, towed disabled power boat, with passengers aboard, to safe anchorage.

C. H. Newman, keeper of Pumpkin Island Light Station, Maine, assisted disabled power boat offshore, made temporary repairs, towed to safe anchorage, and furnished food, dry clothing, and lodging to occupant.

C. E. B. Stanley, keeper of Indian Island Light Station, Maine, towed disabled power boat with one man aboard to port.

W. P. Richardson, keeper of Cape Neddick Light Station, Maine, towed the disabled sloop *Vava*, with one man aboard, to anchorage, made repairs, and piloted to York Harbor, Me.

A. C. Holt, keeper of Deer Island Thoro Fare Light Station, Maine, towed disabled power boat to Sand Beach, and on return trip towed disabled lobster smack to Stonington, Me.

E. W. Osgood, assistant keeper of Manana Island Fog Signal Station, Maine, recovered body of drowned woman from sea.

SECOND DISTRICT.

Pollock Rip Shue Light Vessel No. 73, Massachusetts, rescued two men who had gone adrift from their fishing schooner *Rob Roy*.

Arthur L. Payne, keeper, and Elno C. Mott, assistant keeper, of Bakers Island Station, Massachusetts, towed disabled motor boat with two men aboard to Salem.

Relief Light Vessel No. 86 rescued a fisherman in a dory who had become lost from his vessel.

The tender *Shrub* extinguished a fire at Bigelow's boat yard, Monument Beach, Mass.

James L. Hart, keeper, and William J. Howard, first assistant keeper, of Boston Light Station, Massachusetts, and Arthur A. Small, keeper of Narrows Light Station, Massachusetts, rescued from drowning the second assistant keeper of Boston Light Station and recovered boat which had capsized.

William L. Anderson, jr., keeper, and Gerald M. Reed, assistant keeper, of Plymouth (Gurnet) Light Station, Massachusetts, assisted Coast Guard in taking 62 men from the U. S. mine sweeper No. 34, *Swan*, which had gone ashore.

The tender *Mayflower* towed the motor boat *Aleppo*, with two occupants aboard, to a place of safety.

Arthur A. Small, keeper of Narrows Light Station, Massachusetts, rendered assistance to the motor yacht *Alert*, which had run on a ledge in the vicinity of station with seven passengers aboard.

William L. Anderson, jr., keeper, and Gerald M. Reed, assistant keeper, of Plymouth (Gurnet) Light Station, Massachusetts, assisted in extinguishing a fire in a near-by cottage.

Charles A. Baker, keeper of Butler Flats Light Station, Massachusetts, towed the sloop *Empress*, with two men aboard, to Fairhaven, Mass.

THIRD DISTRICT.

J. A. Davis, keeper of Saybrook Breakwater Light Station, Connecticut, rescued a man who had fallen from a rock into the water while fishing and furnished him dry clothing and hot drink.

Leonard Fuller, keeper of Falkner Island Light Station, Connecticut, towed the disabled boat *Lancross III*, which was adrift with two men and seven women aboard, to Stony Creek for repairs.

James B. Murdock, keeper of Rondout North Dike Light Station, New York, assisted a Canadian seaplane owned by Bishop Barker, which was forced to land on account of engine trouble.

Daniel F. McCoart, keeper of West Bank Light Station, New York, repaired leaking canoe containing two men.

John H. Paul, keeper of Borden Flats Light Station, Rhode Island, rescued two men whose boat had capsized and recovered the oars and other equipment.

William H. Fido, keeper of Cumberland Head Light Station, New York, rendered assistance to disabled motor boat, aided the occupants ashore, and provided repairs for boat.

The tender *Larkspur* assisted in hauling into deep water the racing sloop *Bat*, owned by Donald Scott, which had run ashore with three men aboard.

The keepers of Southwest Ledge Light Station, Connecticut, rendered assistance to occupants of U. S. barge No. 247, that was cast upon New Haven Breakwater, and furnished food and lodging to occupants at station.

William Hardwick, keeper of Bridgeport Harbor Light Station, Connecticut, rescued seven persons from wrecked vessel in vicinity of Stratford Shoal Light, furnished them food and dry clothing at station, and recovered lifeboat.

W. J. Stanton, keeper of Housatonic River Breakwater Light Station, Connecticut, rescued from drowning a hunter whose boat had overturned.

E. J. Smith, keeper of Conimicut Light Station, Rhode Island, furnished food and lodging to men of motor boat owned by Lord Dry Dock Co., Providence, R. I., which had run aground near the station and which later sank.

Walter A. Storey, first assistant keeper of Execution Rocks Light Station, New York, rendered assistance to disabled motor launch which had run aground, towed to station, and assisted in getting launch afloat.

Scotland light vessel No. 11, New Jersey, went to assistance of the disabled schooner *Amos Briggs*, which was adrift, and rescued five men.

The keepers of Execution Rocks Light Station, New York, went to the assistance of a man in a disabled motor boat which was drifting toward the channel and furnished him shelter at the light station.

Ferdinand Heizman, keeper of Great Captain Island Light Station, Connecticut, rescued occupant of a motor boat during storm and recovered the boat.

Walter A. Storey, first assistant keeper, and Leonard Hainsworth, second assistant keeper, of Execution Rocks Light Station, New York, rescued two men whose canoe had capsized during windstorm, recovered the canoe, owned by Oscar de L. Mayer, and furnished food and clothing to the men at station.

Harry R. McCarthy, keeper, John J. Horlacher, first assistant keeper, and Orrin F. Merry, second assistant keeper, of Stratford Shoal (Middle Ground) Light Station, New York, went to assistance of the fishing boat *Emma M.*, with five men aboard, which dragged anchor and drifted onto rocks during gale, and towed to safe anchorage.

The tender *Panzy* picked up an open boat with fisherman aboard, which had been adrift all night in Long Island Sound during gale, furnished food to fisherman, and landed him at New Haven, Conn.

FOURTH DISTRICT.

John E. Collins, keeper of Reedy Island Range Front Light Station, Delaware, towed the motor boat *Nautilus*, with three women and two men aboard, to place of safety.

Robert C. Taylor, keeper, and Floyd Schmierer, second assistant keeper, of Harbor of Refuge Light Station, Delaware, rendered assistance to an injured man whose power boat was drifting to sea in a northeaster.

The tender *Woodbine* towed the disabled yacht *Caprice II* to Wilmington, Del.

John E. Collins, keeper of Reedy Island Range Front Light Station, Delaware, towed about 7 miles the disabled freight boat *Vigilant*, which had run aground.

Harry E. Spencer, keeper, and Robert B. Davidson, assistant keeper, of Liston Range Rear Light Station, Delaware, extinguished fire near the station, which threatened to destroy several near-by buildings.

FIFTH DISTRICT.

The tender *Columbine* towed the disabled motor boat *Anna May* to port.

L. R. O'Neal, keeper of White Shoal Light Station, Virginia, assisted in repairing disabled engine of motor boat with four persons aboard.

E. H. Riggs, keeper, I. C. Meekins, first assistant keeper, and Barney Thomas, third assistant keeper, of Cape Henry Light Station, Virginia, rendered assistance to occupants of a disabled hydroplane.

J. B. Johansen, keeper, and E. C. Tyler, assistant keeper, of Craighill Channel Range Front Light Station, Maryland, towed disabled motor boat to station, with occupants aboard, and provided a sail for trip to port.

James B. Cox, keeper of Long Shoal Light Station, North Carolina, towed the disabled U. S. naval seaplane *NC-2* to station and furnished food and lodging to occupants until arrival of the tender *Juniper*.

The tender *Juniper* towed the disabled U. S. naval seaplane *NC-2* from Long Shoal Light Station to Norfolk, Va., and furnished food and lodging to seven occupants.

C. W. Pugh, keeper of Roanoke Marshes Light Station, North Carolina, assisted five members of the U. S. naval seaplane *NC-2* to shore for night's lodging and returned them to seaplane the next morning.

The tender *Orchid* established a buoy off Cape Henlopen to mark wreck of U. S. S. *S-5* at sacrifice of three holidays.

I. D. Peterson, keeper of Killick Shoal Light Station, Virginia, floated the U. S. naval seaplane *NC-8*, which had grounded.

The tender *Juniper* floated the tugboat *Southland*, which had run aground in North River.

The tender *Maple* removed the family of the captain and their personal property from the disabled power boat *Stroller* and afterwards beached the boat.

W. F. McDorman, keeper of Great Shoals Light Station, Virginia, rescued a motor boat which had drifted from schooner *Eddie*.

The tender *Jessamine* floated the power boat *Maggie C.*, which had grounded on Bodkin Point Shoal, Maryland.

T. H. Baum, keeper of Long Shoal Light Station, North Carolina, cut adrift a string of 15 barges which had become entangled around the light station and threatened considerable damage.

The tender *Orchid* towed to safety the tug *John F. Lewis*, with the hulk *Caskata* in tow.

W. B. Clifton, keeper of Roanoke River Light Station, North Carolina, towed disabled boat to place of safety and provided food and lodging for occupants overnight at station.

J. T. Twiford, keeper of Thimble Shoal Light Station, Virginia, towed disabled motor boat to station and made repairs to engine.

A. M. Meekins, first assistant keeper, and C. P. Morgan, second assistant keeper, of Thimble Shoal Light Station, Virginia, rendered assistance to the tugboat *Summit*, which had become disabled by loss of propeller wheel in the vicinity of the station.

William J. Tate, keeper of North Landing River, etc., aids, North Carolina, assisted in floating a laden schooner, a scow, and a small yacht, which were stranded in vicinity of reservation.

Jesse M. W. Shockley, keeper of Sharps Island Light Station, Maryland, towed the disabled motor boat *Edna*, Capt. R. R. North, jr., owner, to Black Walnut Harbor, Md.

The tender *Juniper* towed into deep water the schooners *Iowa* and *Lucy May*, Capts. M. Hill and E. Goulden, owners, respectively, which had run aground about 1 mile south of Long Point, N. C.

The tender *Laurel* floated into deep water the U. S. Engineer steam tug *Richard Caswell*, which had run aground in Currituck Sound, N. C.

William J. Tate, keeper of North Landing River, etc., aids, North Carolina, floated a submarine chaser which had grounded near the station, and towed barge, with rescued crew of burned tugboat on board, to landing.

H. T. Austin, keeper of Newport News Middle Ground Light Station, Virginia, rendered assistance to occupants of a motor boat owned by M. Hilden which had become uncontrollable during a storm.

John E. Stubbs, assistant keeper, and Edward Linton, additional keeper, of Baltimore Light Station, Maryland, towed to station a small boat with two men aboard which had been drifting near by and furnished food and lodging to men.

John F. Jarvis, keeper, and Robert F. Powell, assistant keeper, of Tue Marshes Light Station, Virginia, rendered assistance in sending a message for aid for the motor launch from the United States naval air station, which was sighted in distress in the vicinity of station.

Caleb B. Stowe, keeper of Turkey Point Light Station, Maryland, towed disabled power boat to Town Point Wharf, Md., with seven men aboard, which was sighted adrift in the vicinity of station.

SIXTH DISTRICT.

The tender *Mangrove* assisted in towing to the plant of the Charleston Dry Dock & Machine Co. their 8,000-ton floating dry dock, valued at \$500,000, which had gone adrift in Charleston Harbor, S. C.

The tender *Cypress* recovered anchor and chain of the steamship *Pinellas*, owned by the United States Shipping Board, which had slipped off in Charleston Harbor, S. C.; also assisted in pulling the steamship *National Bridge*, owned by the United States Shipping Board, off of Bald Head Shoal at entrance Cape Fear River, N. C., and towed it into deep water.

The tender *Palmetto* assisted in floating the steamship *Grecian*, owned by the Merchants & Miners Line, which had run aground in St. Johns River, Fla.

A. F. Wichmann, keeper, and L. R. Munn, first assistant keeper, of Cape Romain Light Station, South Carolina, assisted in floating the yacht *Runaway*, which had run aground about 2 miles from the station.

C. P. Honeywell, keeper of Cape Canaveral Light Station, Florida, rendered assistance and furnished shelter to the captain and 17 members of the crew of the lumber-laden British steamship *Albert Soper*, which was wrecked about 5 miles from the station.

C. P. Honeywell, keeper, and J. B. Butler, first assistant keeper, of Cape Canaveral Light Station, Florida, furnished food and clothing to 10 members of the crews of two United States Navy hydroplanes which were beached near the station.

C. P. Honeywell, keeper of Cape Canaveral Light Station, Florida, assisted in landing parties from two power boats and in securing a supply of gasoline for the boats.

C. P. Honeywell, keeper and O. F. Quarterman, second assistant keeper, of Cape Canaveral Light Station, Florida, assisted in protecting the light station from forest fire by back-firing the underbrush.

Thomas Knight, keeper, and J. B. Isler, second assistant keeper, of Hillsboro Inlet Light Station, Florida, extinguished a forest fire in the vicinity of the station by the cutting of a trail, thereby preventing any damage to lighthouse property.

Thomas Knight, keeper and son, of Hillsboro Inlet Light Station, Florida, assisted the captain and one member of crew to reach shore from capsized boat and supplied gasoline to the yacht *Caroline*, which was anchored near the station.

John Lindquist, keeper, and R. Heisser, first assistant keeper, of Mosquito Inlet Light Station, Florida, went to assistance of crew of the British schooner *Selesté D.*, owned by H. S. Barnaby, which was wrecked and abandoned in the vicinity of the station and piloted their launch to station; furnished the captain and crew of six men with provisions and lodging.

EIGHTH DISTRICT.

G. R. Smith, keeper, and L. R. Smith, assistant keeper, of Red Fish Bar Cut Light Station, Texas, rescued a man and a boy from drowning whose motor launch had sunk.

The officers and crew of the lighthouse tender *Sunflower* promptly moved the tender to place of safety during the burning of Pier No. 35, Galveston, Tex.

J. D. Balsillie, keeper; A. C. Marquardt, first assistant keeper; and T. Wenman, second assistant keeper, of Galveston Harbor Light and Fog Signal Station, Texas, assisted into deep water the U. S. Engineer launch *Col. Smead*, with barge in tow, which had gone aground.

S. Gibbon, keeper of Mobile Channel Lights, Alabama, rescued from drowning a laborer who fell overboard while attempting to go aboard the depot launch.

H. Brouwer, keeper, and D. C. Powell, assistant keeper, of Round Island Light Station, Mississippi, assisted in floating the disabled auxiliary boat *A. H. Daugherill*, which had grounded during fog.

T. N. Clarisse, keeper of Ship Island Light Station, Mississippi, towed the disabled pilot boat *Zoe* to safe anchorage.

Niels Nilsen, keeper of Pascagoula River Entrance Lights, Mississippi, towed the launch *Norma W*, with 12 passengers aboard, to place of safety during strong.

R. F. Steen, keeper of South Pass East Jetty Light Station, etc., Louisiana, towed to station skiff with two men aboard which had drifted about 3 miles in strong current into the Gulf of Mexico.

NINTH DISTRICT.

E. Dreyer, second officer of the tender *Lilac*, rescued three occupants of the cap-sized sailboat *Isabella* and recovered the sailboat.

TENTH DISTRICT.

The tender *Crocus* towed the disabled U. S. Engineer tug *Oswegatchie* and dredge *Sodus* to Charlotte, N. Y.

William E. Frazier, assistant keeper of Galloo Island Light Station, New York, towed the disabled power boat *Glinda*, with two men aboard, to Grenadier Island, N. Y.

ELEVENTH DISTRICT.

F. G. Sommer, keeper, and D. McRae, first assistant keeper, of Detour Light Station, Michigan, pulled the naval radio service launch off rocks to place of safety.

W. S. Hall, assistant keeper of Middle Neebish Cut Light Station, Michigan, towed the disabled motor boat *R-621* to shore and assisted in making temporary repairs.

R. W. Campbell, keeper of Middle Neebish Cut Light Station, Michigan, towed disabled motor boat ashore in northeast gale.

E. B. Gates, keeper of Passage Island Light Station, Michigan, towed disabled motor boat to shore.

J. Brooks, keeper of Au Sable Light Station, Michigan, sounded distress signals, which resulted in the saving of a disabled fishing tug that was drifting rapidly.

Otto Redman, keeper, and J. T. Story, assistant keeper, of Windmill Point Light Station, Michigan, rescued four men whose boat had capsized and recovered boat.

H. P. Crittenden, keeper of Crisp Point Light Station, Michigan, towed the disabled motor boat *Gladys L*, with four passengers aboard, to shore.

R. W. Campbell, keeper, and W. S. Hall, assistant keeper, of Middle Neebish Cut Light Station, Michigan, pulled the sloop *T-631* off rocks and made temporary repairs; also towed the disabled patrol boat *Vigilant* of the U. S. Coast Guard to a point where it was taken in tow by another patrol boat.

H. P. Crittenden, keeper of Crisp Point Light Station, Mich, assisted the Coast Guard crew in rendering assistance to the disabled motor boat *Sea Fox* during a severe gale.

TWELFTH DISTRICT.

James McCormick, keeper; L. A. Vannatter, first assistant keeper; O. E. Dame, second assistant keeper; and N. A. Nelson, third assistant keeper, of South Fox Island Light Station, Michigan, towed fishing tug from South Fox Island to Northport, Mich; hauled the wrecked fishing tug *Emma S. Olson* to shore and assisted in removal of engine; and assisted in preventing the launch *Aida*, of Milwaukee, Wis., owned by Smith Bros., from going ashore during storm.

James McCormick, keeper, and L. A. Vannatter, first assistant keeper, of South Fox Island Light Station, Michigan, and R. W. Johnson, keeper, and E. C. Johnson, assistant keeper, of Grand Traverse Light Station, Michigan, rendered assistance to the launch *Dolphin* which had been blown ashore.

F. A. Drew, keeper of Green Island Light Station, Wisconsin, towed the disabled yacht *Vanity*, owned by Capt. Knutson, to Menominee, Mich.

Eleven-Foot Shoal Light Vessel No. 60, Michigan, rendered assistance to the disabled hydroplane from the United States Great Lakes Naval Training Station until relieved by passing freighter.

Joseph Napeizinski, keeper, and Edward Carron, assistant keeper, of Manitowoc Breakwater Light Station, Wisconsin, assisted in search for bodies of two drowned boys.

Grays Reef Light Vessel No. 57, Michigan, hoisted the launch *Shep*, with three occupants, aboard the light vessel and made repairs to the engine.

R. W. Johnson, keeper of Grand Traverse Light Station, Michigan, furnished gasoline to launch which was sighted adrift.

H. R. Bevry, keeper; Julius Lonne, first assistant keeper; and William H. Nash, second assistant keeper, of Wind Point Light Station, Wisconsin, rescued two boys who were afloat on a raft that had blown out into deep water.

THIRTEENTH DISTRICT.

The tender *Dandelion* assisted in pulling the steamer *Julius F. Silber*, owned by R. J. Paschal, off reef in vicinity of Enterprise Island.

SIXTEENTH DISTRICT.

The tenders *Cedar* and *Fern* floated the Standard Oil tanker *Atlas*, which was stranded in Snow Pass, Alaska; also assisted in searching for the assistant keeper of Mary Island Light Station and one other person who were lost on Mary Island, Alaska, and in recovering the bodies of these men who had died from exposure.

SEVENTEENTH DISTRICT.

Shirley Cowan, first assistant keeper of Cape Flattery Light Station, Washington, towed to safety the schooner *William Bowden*, which was becalmed near the breakers at mouth of Quilayute River, Wash.

William J. Thomas, keeper of Point Wilson Light Station, Washington, telephoned for assistance and promptly reported to the office of the Admiral Line a collision off Point Wilson between the steamers *Governor*, of the Admiral Line, and the *Hartland*, of the United States Shipping Board, which resulted in the sinking of the *Governor* and the loss of nine lives.

Bernard B. Meagher, keeper of Smith Island Light Station, Washington, made fast the damaged launch *June G*, owned by Dr. W. Graham, Seattle, Wash., furnished shelter to the crew, and sent station boat for assistance; also assisted in hauling off the Canadian launch *New Fraser*, which had grounded on Minor Island, Wash., and sent station boat for assistance.

Albert Beyer, keeper of Destruction Island Light Station, Washington, rendered assistance to the launch *Myrtle May*, owned by Marco Radonick, with scow in tow, and furnished shelter and provisions to crew and passengers; also rendered assistance to five men of the launch *Whipple* and furnished them food and dry clothing.

L. A. Borchers, keeper of Turn Point Light Station, Washington, towed disabled launch, with three men aboard, to place of safety.

NINETEENTH DISTRICT.

The tender *Kukui* assisted in pulling the steamship *West Eldara*, of the United States Shipping Board, off of reef at Barbers Point, Oahu Island, and towed barge of salvaged cargo to Honolulu; also rendered valuable service in locating the schooner *Annie E*, of the City Mill Co., which had sprung several leaks, and in rescuing the crew and destroying the wrecked vessel.

Edward E. Robins, keeper of Honolulu Harbor Light Station, Hawaii, and Thomas Kalawaia, keeper of Honolulu Lighthouse Depot, Hawaii, rescued man from drowning who had jumped into channel from passing steamer.

Manuel Ferreira, keeper of Barbers Point Light Station, Hawaii, recovered rowboat of the Inter-Island Steam Navigation Co., which had drifted ashore on reef near the station.

Edward E. Robins, keeper of Honolulu Harbor Light Station, Hawaii, rendered assistance in recovering United States Army rowboat adrift in heavy sea.

DAMAGE BY COLLISION.

During the fiscal year there were 53 cases of collisions by vessels with aids to navigation, tenders, and other lighthouse property, causing damages which have been repaired or paid for by the parties responsible therefor, or proper measures taken by the Lighthouse Service to compel payment by owners of the vessels where such owners or vessels were identified.

During the fiscal year there were two cases of collisions in which vessels of the Lighthouse Service were found to have been responsible for damage to other vessels or property. These two claims, together with four others which had been previously adjusted under the provisions of section 4 of the act of June 17, 1910 (36 Stat., 537), were appropriated for by Congress in deficiency act approved March 1, 1921, in the total amount of \$436.12. In one case no claim has been or will be made for repairing damages, which is estimated at \$25.

PUBLICATIONS OF THE LIGHTHOUSE SERVICE.

[Since Jan. 1, 1919, light lists and buoy lists have been sold.]

Publications.	Number distributed.	Date of last edition.	Cost of last edition.
Light lists:			
Atlantic and Gulf coasts of United States.....	1,253	Jan. 21, 1921	\$1,988.89
Pacific coast of United States, etc.....	822	...do.....	928.10
Great Lakes of United States and Canada.....	304	Apr. 1, 1921	740.32
Upper Mississippi River and tributaries.....	189	Jan. 15, 1921	429.79
Ohio River and tributaries.....	248	Sept. 15, 1920	171.82
Lower Mississippi River and tributaries.....	251	Nov. 15, 1920	143.70
Buoy lists:			
First district.....	629	May 1, 1921	256.17
Second district.....	686	May 15, 1921	366.03
Third district.....	743	...do.....	572.17
Fourth district.....	727	June 1, 1921	109.58
Fifth district.....	702	May 15, 1921	838.37
Sixth district.....	637	Mar. 1, 1921	347.56
Seventh district.....	639	Apr. 1, 1921	287.29
Eighth district.....	673	Sept. 1, 1920	516.66
Ninth district.....	549	Nov. 15, 1920	223.84
Tenth district.....	305	Apr. 1, 1921	139.49
Eleventh district.....	365	...do.....	364.14
Twelfth district.....	356	...do.....	163.88
Sixteenth district.....	239	June 1, 1921	205.51
Seventeenth district.....	228	...do.....	313.78
Eighteenth district.....	64	...do.....	149.49
Nineteenth district.....	52	Sept. 1, 1919	45.00
Miscellaneous publications:			
Weekly Notice to Mariners.....	190,750	1921	4,622.42
Annual Report, Commissioner of Lighthouses.....	1,500	1920	704.33
Lighthouse Service Bulletins.....	18,000	1921	238.66

Total number of publications sold in fiscal year 1921, 8,319. Total receipts from sales, \$1,686.65.

COST OF PRINTING FOR LIGHTHOUSE SERVICE, FISCAL YEAR 1921.

Light lists.....	\$4,402.62
Buoy lists.....	5,154.22
Notices to mariners.....	4,736.96
Annual report.....	704.33
Specifications and other publications.....	1,226.04
Forms, reports, record books, etc.....	8,917.13
Total.....	24,141.29

MISCELLANEOUS RECEIPTS.

The following amounts were received by the Lighthouse Service during the year and turned into the Treasury: From sales of property, \$43,801.33; from damages to aids to navigation and other property, \$2,817.78; from leases and rentals, \$6,389.22; recoveries from defaulting contractors, \$378.16; total, \$53,386.49.

APPROPRIATIONS FOR THE BUREAU OF LIGHTHOUSES AND THE LIGHTHOUSE SERVICE, SIXTY-SIXTH CONGRESS, THIRD SESSION, AND SIXTY-SEVENTH CONGRESS, FIRST SESSION, 1920-21, NOT LISTED IN PREVIOUS ANNUAL REPORT.

Title.	Act.	Amount.
Maintenance		
Salaries, Bureau of Lighthouses, 1921.....	Deficiency, Mar. 1, 1921....	\$1,000.00
General expenses, Lighthouse Service, 1921.....	do.....	400,000.00
Salaries, Lighthouse Service, 1921.....	do.....	70,000.00
Retired pay, Lighthouse Service, 1921.....	do.....	1,000.00
Salaries, Bureau of Lighthouses, 1922.....	Legislative, Mar. 3, 1921....	68,200.00
General expenses, Lighthouse Service, 1922.....	Sundry civil, Mar. 4, 1921..	4,200,000.00
Salaries, Lighthouse Service, 1922.....	do.....	1,300,000.00
Salaries, Lighthouse vessels, 1921.....	do.....	1,800,000.00
Salaries, Lighthouse Service, 1922.....	do.....	400,000.00
Retired pay, Lighthouse Service, 1922.....	do.....	75,000.00
Total.....		8,315,200.00
Special		
Vessels for Lighthouse Service.....	Sundry civil, Mar. 4, 1921..	1,000,000.00
Garretts Ferry Light Station, Texas.....	do.....	6,000.00
Gift to the Bureau of Lighthouses, Ohio.....	Deficiency, Mar. 1, 1921....	7,000.00
Damage claims, collisions of vessels.....	do.....	436.12
Total.....		1,013,936.12
Grand total.....		9,329,236.12

EXPENDITURES DURING THE FISCAL YEAR 1921 FROM APPROPRIATIONS FOR THE LIGHTHOUSE SERVICE.

(Obligations incurred are not included.)

Salaries:	
Bureau of Lighthouses, 1920.....	\$2,662.99
Bureau of Lighthouses, 1921.....	61,060.84
General expenses, Lighthouse Service:	
1919.....	389,307.81
1920.....	871,461.79
1921.....	3,683,539.58
Certified claims.....	60,938.15
Salaries of keepers of lighthouses:	
1920.....	35,874.44
1921.....	1,256,715.11
Certified claims.....	3,003.54
Salaries, lighthouse vessels:	
1919.....	2,314.80
1920.....	83,322.11
1921.....	1,706,021.50
Salaries, Lighthouse Service:	
1919.....	196.41
1920.....	5,537.35
1921.....	386,884.73
Increase of compensation, Department of Commerce:	
1920.....	23,158.67
1921.....	861,626.83
Retired pay, Lighthouse Service:	
1920.....	1,668.24
1921.....	67,172.09
Total maintenance.....	9,504,466.98

SPECIAL WORKS.

General:	
Repairing and rebuilding aids to navigation, Atlantic coast.....	\$71,929.79
Light vessels for general service.....	12,603.93
Light vessels for general lake service.....	58,971.20
Radio installations on lighthouse tenders.....	14,232.61
Vessels for Lighthouse Service.....	844,224.63
Light-keepers' dwellings.....	9,873.48
Second district:	
Woods Hole Lighthouse Depot, Massachusetts.....	411.84
Nantucket Harbor Fog Signal, Massachusetts.....	996.20
Depot for second lighthouse district.....	57,223.62
Third district:	
Aids to navigation, Hudson River, N. Y.....	341.61
Hunts Point Light Station, New York.....	1,253.05
Execution Rocks Light Station, New York.....	6,147.64
Staten Island Lighthouse Depot, New York (wharves).....	1,906.55
Staten Island Lighthouse Depot, New York (office).....	4.28
Ambrose Channel lighted buoys, New Jersey.....	256.13
Riprap protection for light stations, third lighthouse district.....	28,055.65
National security and defense, Department of Commerce, 1919 (Tompkinsville).....	57,367.39
Fourth district:	
Joe Flogger Shoal Light Station, Delaware River.....	9,174.65
Fifth district:	
Aids to navigation, Chesapeake Bay, Md. and Va.....	861.49
Diamond Shoal Light Vessel, North Carolina.....	135,551.66
Fifth lighthouse district gas buoys.....	23,861.79
Sixth district:	
Aids to navigation, St. Johns River, Fla.....	14,367.28
Seventh district:	
Aids to navigation, Florida Reefs, Fla.....	47,153.00
Repairing and rebuilding aids to navigation, seventh and eighth lighthouse districts...	64,466.50
Eighth district:	
Southwest Pass Light Vessel, Mississippi River.....	1,613.90
Aids to navigation, Atchafalaya Entrance Channel, La.....	2,210.59
Repairing and rebuilding aids to navigation, Gulf of Mexico.....	20,818.28
Aids to navigation, Mississippi River, La.....	2,862.88
Tender and barge, eighth lighthouse district.....	15.39
National security and defense, Department of Commerce (Caribbean Sea).....	2,203.76
Sand Island Light Station, Alabama.....	5.40
Ninth district:	
Aids to navigation, Guantanamo Bay, Cuba.....	1,461.36
Point Borinquen Light Station, Porto Rico.....	26,293.58
Point Jiguero Light Station, Porto Rico.....	13,552.94
Tenth district:	
Aids to navigation, Conneaut Harbor, Ohio.....	12,641.57
Aids to navigation, Toledo Harbor, Ohio.....	88.00
Aids to navigation, Fairport Harbor, Ohio.....	20,404.82
Eleventh district:	
Detroit River lights, Michigan.....	3,838.31
Aids to navigation, Fighting Island Channel, Detroit River, Mich.....	2,633.13
Sand Hills Light Station, Michigan.....	53.20
Aids to navigation, Keweenaw Waterway, Michigan.....	615.87
Detroit Lighthouse Depot, Michigan.....	3,865.02
Aids to navigation, St. Marys River, Mich.....	31,765.86
Spectacle Reef Light Station, Michigan.....	391.20

Twelfth district:	
White Shoal Light Station, Michigan.....	\$1,954.82
Manitowoc Breakwater Light Station, Wisconsin.....	2,822.88
Aids to navigation, Indiana Harbor, Ind.....	10,846.33
Sixteenth district:	
Aids to navigation, Alaska.....	10,168.83
Depot for sixteenth lighthouse district.....	3,639.95
Seventeenth district:	
Kellett Bluff Light Station, Washington.....	469.98
Aids to navigation, Washington and Oregon.....	9,532.66
Nineteenth district:	
Aids to navigation, Pearl Harbor, Hawaii.....	37,288.58
Total, special works.....	1,185,355.26
Total maintenance appropriations.....	9,594,468.98
Total, special works.....	1,185,355.26
Grand total.....	10,779,822.24

ITEMIZED ESTIMATES OF APPROPRIATIONS FOR THE FISCAL YEAR 1923, AND ITEMIZED STATEMENTS OF EXPENDITURES FOR THE FISCAL YEARS 1921 AND 1922, AS REQUIRED BY THE ACT OF CONGRESS APPROVED JUNE 10, 1921 (42 STAT., 20).

[The expenditures herein stated are in part estimated, owing to the fact that all obligations incurred for the year 1921 have not yet been settled. Articles of supplies purchased for general stock have also been distributed, approximately, to features to be benefited. This table refers to appropriations made in the sundry civil appropriation act and does not include Bureau salaries in Washington nor the cost of publications, otherwise provided for. This statement contains also amounts for salaries and wages under certain items which are shown separately in the Book of Estimates, 1923.]

Item.	Estimate, 1923.	Estimate, 1922.	Expendi- tures, 1921.
GENERAL EXPENSES, LIGHTHOUSE SERVICE.			
Lights and fog signals:			
Rations and provisions.....	\$237,000	\$238,000	\$238,394
Fuel and rent for keepers.....	90,000	92,000	92,008
General supplies.....	350,000	360,000	365,608
Repairs and improvements, including grounds and outbuildings.....	365,000	362,000	362,503
Establishing lights and fog signals, including sites.....	25,000	24,000	23,492
Necessary additional land for light stations.....	300	50	606
Incidental expenses.....	8,750	9,000	8,809
Daymarks and spindles:			
Establishment, including sites.....	4,000	3,500	3,448
Repairs and improvements.....	7,000	5,820	6,554
Incidental expenses.....	300	300	75
Post lights:			
Establishment.....	5,500	5,550	5,732
Wages of laborers attending lights.....	272,000	270,000	268,377
Supplies.....	33,000	34,000	37,309
Repairs and improvements.....	23,000	22,000	22,038
Incidental expenses.....	1,000	1,000	917
Buoys:			
Establishment.....	75,000	75,000	75,542
Supplies.....	195,000	195,000	217,095
Repairs.....	94,000	95,000	117,310
Incidental expenses.....	1,000	1,000	784
Tenders:			
Rations and provisions.....	338,000	335,000	371,577
Supplies.....	780,000	777,000	826,926
Repairs.....	405,000	401,000	401,913
Incidental expenses.....	20,000	20,000	27,999
Light vessels:			
Rations and provisions.....	143,000	140,000	147,198
Supplies.....	185,000	190,000	216,253
Repairs.....	170,000	165,000	161,263
Incidental expenses.....	2,500	2,500	2,916
Depots:			
Pay of laborers and mechanics.....	192,000	195,000	198,533
Rent.....	6,300	6,300	6,300
Supplies.....	92,000	95,000	102,940
Repairs and improvements.....	100,000	100,000	100,072
Incidental expenses.....	14,000	14,625	16,462
Office:			
Technical books and periodicals.....	320	325	339
Stationery and office supplies.....	17,000	17,000	17,913
Telegraph and telephone.....	12,000	12,000	12,139
Traveling expenses and mileage.....	32,000	32,000	32,417
Rent.....	4,109	4,109	4,109
Freight, expressage, and cartage.....	95,000	95,000	95,441
Incidental expenses.....	4,921	4,921	5,191
Total.....	4,400,000	4,400,000	4,595,590
Appropriation, 1923.....	\$4,500,000		
Appropriation, 1922.....	4,500,000		

ITEMIZED ESTIMATES OF APPROPRIATIONS FOR THE FISCAL YEAR 1923, ETC.—CON.

Item.	Estimate, 1923.	Estimate, 1922.	Expendi- tures, 1921.
SALARIES OF KEEPERS OF LIGHTHOUSES.			
Salaries of lighthouse keepers.....	\$1, 300, 000	\$1, 300, 000	\$1, 297, 460
Appropriation, 1922.....	\$1, 300, 000		
Appropriation, 1921.....	1, 300, 000		
SALARIES, LIGHTHOUSE VESSELS.			
Salaries and wages, lighthouse tenders.....	1, 198, 286	1, 190, 146	1, 253, 203
Salaries and wages, light vessels.....	601, 714	609, 854	614, 205
Total.....	1, 800, 000	1, 800, 000	1, 867, 408
Appropriation, 1922.....	\$1, 800, 000		
Appropriation, 1921.....	1, 870, 000		
SALARIES, LIGHTHOUSE SERVICE.			
Salaries, authorized district office, technical and depot forces.....	460, 000	400, 000	391, 752
Appropriation, 1922.....	\$400, 000		
Appropriation, 1921.....	400, 000		
RETIRED PAY, LIGHTHOUSE SERVICE.			
Retirement pay.....	80, 000	75, 000	68, 845
Appropriation, 1922.....	\$75, 000		
Appropriation, 1921.....	71, 000		

SUMMARY OF ESTIMATES OF APPROPRIATIONS FOR THE LIGHTHOUSE SERVICE FOR THE FISCAL YEAR 1923.

FOR GENERAL MAINTENANCE OF THE LIGHTHOUSE SERVICE.

Salaries, Bureau of Lighthouses.....	\$92, 000
General expenses, Lighthouse Service.....	4, 400, 000
Salaries, keepers of lighthouses.....	1, 300, 000
Salaries, lighthouse vessels.....	1, 800, 000
Salaries, Lighthouse Service.....	460, 000
Retired pay, Lighthouse Service.....	80, 000
Total.....	8, 132, 000

FOR SPECIAL WORKS.

Group 1. Works urgently necessary for the safety or immediate needs of navigation and for the preservation of existing structures or equipment, for the full utilization of other public improvements, or for the efficient equipment of the Lighthouse Service:	
1. Constructing or purchasing and equipping tenders and light-vessels.....	1, 500, 000
2. Lighthouse depot for fifth district, enlargement, improvement, or establishment of new depot.....	275, 000
3. Delaware Bay entrance, improvement of aids to navigation.....	138, 000
4. Alaska, aids to navigation.....	125, 000
5. Calumet Harbor, Ill., improvements.....	66, 000
6. Spectacle Reef (Mich.) Light Station, improvements.....	14, 500
7. Cape Spencer, Alaska, establishment of light and fog-signal station.....	175, 000
8. Newport (R. I.) Lighthouse Depot.....	82, 300
9. Radio fog-signal installations.....	50, 000
10. Detroit (Mich.) Lighthouse Depot.....	50, 000
11. Detroit River, Mich., patrol boat.....	
12. Raritan Bay and connected waters, New York and New Jersey, aids to navigation.....	100, 000
13. Galveston Bay and Houston Channel, Tex., aids to navigation.....	125, 000
14. Hawaiian Islands Lighthouse Depot, construction and equipment.....	120, 000
15. Lighthouse depot for seventh district, establishing.....	225, 000
16. Potomac River, Md., aids to navigation.....	90, 000
17. Lighthouse depot for eighth district, construction.....	132, 750
18. Charleston (S. C.) Lighthouse Depot, improvements.....	60, 000
19. Virgin Islands, West Indies, aids to navigation.....	50, 000
20. Ludington, Mich., aids to navigation.....	70, 000
21. Tampa Bay, Fla., aids to navigation.....	17, 500
22. Goat Island (Calif.) Lighthouse Depot, keepers' dwellings.....	16, 500
23. Depot for second lighthouse district, completion.....	85, 500
24. San Juan (P. R.) Lighthouse Depot, improvement.....	60, 000
25. Ketchikan (Alaska) Lighthouse Depot, completion.....	75, 000
26. California, aids to navigation.....	25, 000
27. Florida coasts, aids to navigation.....	50, 000
28. Goat Island (Calif.) Lighthouse Depot, improvements.....	68, 000

GROUP 1—Continued.

29. Sandusky Bay, Ohio, aids to navigation.....	\$108,000
30. Oswego Harbor, N. Y., aids to navigation.....	13,000
Authorized by law.....	\$2,808,500
Not authorized.....	1,158,500
Total, group 1.....	3,967,050

Group 2. Works considered essential for the needs of navigation and the equipment of the Lighthouse Service, and which it is recommended be undertaken as resources permit, are submitted with estimate of cost. These items have been recommended by the superintendents of the lighthouse districts:

FIRST LIGHTHOUSE DISTRICT.

Tumbler Island, Me., establishment of light.....	5,800
Otter Island, Me., establishment of light.....	3,600
Ram Island, Me., establishment of light.....	6,000
Portland, Me., depot for first lighthouse district.....	180,000
Rockland (Me.) Lighthouse Depot.....	28,000

SECOND LIGHTHOUSE DISTRICT.

Woods Hole (Mass.) Lighthouse Depot, improvements.....	18,000
Brant Point (Mass.) Light Station, improvements.....	5,000
Second lighthouse district, riprap protection for light stations.....	17,250
Cape Cod (Mass.) Light Station, improvements.....	5,620

THIRD LIGHTHOUSE DISTRICT.

Great Salt Pond (R. I.) Light Station, completion.....	53,000
Staten Island (N. Y.) Lighthouse Depot, machine shop.....	15,000
Coney Island (N. Y.) Light Station, right of way.....	5,000
Staten Island (N. Y.) Lighthouse Depot, extension of wharves.....	119,600
Sag Harbor, N. Y., improvements and establishment of new aids to navigation.....	58,500
Lake Champlain, N. Y. and Vt., improvements to aids to navigation.....	147,000
Third lighthouse district, riprap protection for light stations.....	190,000

FIFTH LIGHTHOUSE DISTRICT.

Norfolk, Va., to Beaufort, N. C., inland waterway, aids to navigation.....	92,000
Cape Henry (Va.) Light Station, improvements.....	24,300
Fifth lighthouse district, additional buoys.....	44,600

SIXTH LIGHTHOUSE DISTRICT.

Sixth lighthouse district, additional gas buoys.....	60,000
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SEVENTH LIGHTHOUSE DISTRICT.

Lake Okechobee and Hicpochee, Fla., establishment of aids to navigation.....	85,000
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EIGHTH LIGHTHOUSE DISTRICT.

Sand Island (Ala.) Light Station, keepers' dwelling.....	12,000
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NINTH LIGHTHOUSE DISTRICT.

Point Jiguero (P. R.) Light Station, completion.....	14,500
Port Real, P. R., establishment of light station.....	40,000
San Juan, P. R., office building.....	29,700

TENTH LIGHTHOUSE DISTRICT.

Fairport Harbor, Ohio, aids to navigation, completion.....	37,800
Charlotte (N. Y.) Light Station, improvements.....	44,000
Erie Harbor, Pa., aids to navigation.....	26,000
Thirty Mile Point, N. Y., aids to navigation.....	32,500

ELEVENTH LIGHTHOUSE DISTRICT.

Marquette (Mich.) Light Station, improvements.....	15,000
West Neebish Channel, St. Marys River, Mich., aids to navigation.....	50,000
Michigan Island, Wis., establishment of light and fog-signal station.....	85,000
Portage Lake, Mich., aids to navigation.....	75,000
Nine Mile Point, Mich., establishment of light and fog-signal station.....	50,000

TWELFTH LIGHTHOUSE DISTRICT.

Lansing Shoal, Mich., establishment of light and fog-signal station.....	304,000
Sturgeon Bay, Wis., aids to navigation.....	49,000
Grand Haven (Mich.) Light Station, improvements.....	12,700
Escanaba (Mich.) Light Station, improvements.....	70,000
Two Rivers, Wis., improvements.....	7,400
Manitowoc (Wis.) Light Station, keepers' dwellings.....	20,050
Milwaukee (Wis.) Lighthouse Depot, additional storage space.....	7,500

SIXTEENTH LIGHTHOUSE DISTRICT.

Yukon River, Alaska, aids to navigation.....	110,000
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DETAILED ESTIMATES.

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SEVENTEENTH LIGHTHOUSE DISTRICT.

Grays Harbor (Wash.) Light Station, improvements.....	\$20,000
Ediz Hook (Wash.) Light Station, improvements.....	12,000
Washington and Oregon, aids to navigation.....	50,000
Brush Point, Wash., establishment of light and fog-signal station.....	46,000
Alki Point (Wash.) Light Station, improvements.....	3,000

EIGHTEENTH LIGHTHOUSE DISTRICT.

Ballast Point, Calif., construction of buoy wharf.....	6,100
Red Rock, Calif., light and fog signal.....	14,350
Point Pinos (Calif.) Light Station, improvements.....	16,500
Santa Barbara (Calif.) Light Station, improvements.....	20,000
Piedras Blancas, Calif., dwelling for assistant keepers.....	5,400

NINETEENTH LIGHTHOUSE DISTRICT.

Cape Kumukahi, Hawaii, establishment of light.....	18,500
Kauhola Point, Hawaii, improvements.....	22,000
Total group 2 (not included in total of estimates).....	2,489,870

RECAPITULATION.

For general maintenance of the Lighthouse Service.....	8,132,000
For special works, group 1.....	3,967,050
Total.....	12,099,050

DETAILED ESTIMATES FOR MAINTENANCE, 1923.

BUREAU OF LIGHTHOUSES.

Salaries.....	\$92,000
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GENERAL EXPENSES, LIGHTHOUSE SERVICE.

For supplies, repairs, maintenance, and incidental expenses of lighthouses and other lights, beacons, buoyage, fog signals, lighting of rivers heretofore authorized to be lighted, light vessels, other aids to navigation, and lighthouse tenders, including the establishment, repair, and improvement of beacons and day marks and purchase of land for same; the establishment of post lights, buoys, submarine signals, and fog signals; the establishment of oil or carbide houses not to exceed \$10,000: *Provided*, That any oil or carbide house erected hereunder shall not exceed \$1,000 in cost; the construction of necessary outbuildings at a cost not exceeding \$1,000 at any one light station in any fiscal year; the improvements of grounds and buildings connected with light stations and depots; restoring light stations and depots and buildings connected therewith: *Provided*, That such restoration shall be limited to the original purpose of the structures; wages of persons attending post lights; pay of temporary employees and field force while engaged on works of general repairs and maintenance and pay of laborers and mechanics at lighthouse depots; rations and provisions or commutation thereof for keepers of lighthouses, working parties in the field, officers and crews of light vessels and tenders, and officials and other authorized persons of the Lighthouse Service on duty on board of such tenders or vessels; and money accruing from commutation for rations and provisions for the above-named persons on board of tenders and light vessels or in working parties in the field may be paid on proper vouchers to the person having charge of the mess of such vessel or party; reimbursement under rules prescribed by the Secretary of Commerce of keepers of light stations and masters of light vessels and of lighthouse tenders for rations and provisions and clothing furnished shipwrecked persons who may be temporarily provided for by them, not exceeding in all, \$5,000 in any fiscal year; fuel and rent of quarters, or commutation thereof, where necessary for keepers of lighthouses; the purchase of land sites for fog signals; the rent of necessary ground for all such lights and beacons as are for temporary use or to mark changeable channels and which in consequence can not be made permanent; the rent of offices, depots, and wharves; traveling expenses, mileage, library books for light stations and vessels, and technical books and periodicals not exceeding \$1,000; traveling and subsistence expenses of teachers while actually employed by States or private persons to instruct the children of keepers of lighthouses; and for all other contingent expenses of district offices and depots and not exceeding \$8,500 for contingent expenses of the office of the Bureau of Lighthouses in the District of Columbia, \$4,400,000.

NOTE.—The estimate submitted is \$200,000 less than the appropriation for 1921, but it is \$200,000 more than that for 1922. During 1921 the service was maintained only by postponing considerable urgent and repair work on vessels, light stations, and depots, by curtailing the purchase of supplies, by laying up several vessels, and otherwise restricting the work. The general upkeep of the plant of the Lighthouse Service has fallen somewhat behind in recent years because of war conditions and insufficiency of funds to do the work necessary at the increased costs. Stocks of supplies have been depleted to an extent that affects the efficiency of the work. The appropriation for the present year—1922, \$4,200,000—is \$900,000

less than the estimate submitted by the department and over \$1,000,000 less than the estimate submitted by the superintendents of lighthouse districts for funds necessary for the maintenance of the service and \$400,000 less than the appropriation for 1921, \$4,600,000. Possible reductions in the cost of operating the service in 1922, as compared with 1921, are as follows:

Decrease in costs of 35 principal supplies, net.....	\$171,000
Decrease in subsistence on vessels.....	45,000
Decrease in pay of per diem men.....	77,000
Total.....	293,000

After a careful study of costs and special consideration of the uncertainty in prices of coal and oil it is not deemed that a reduction of more than \$200,000 from the general expense item of 1921 is warranted in the estimate for the fiscal year 1923. Reasonable allowance must be made for making good deficiencies in upkeep of stations, vessels, property, and stocks of supplies, deficiencies which have accumulated for several years past. Under the allotments which it has been possible to make out of the 1922 appropriation only a limited amount of the most urgent repair and upkeep work can be done this year, and it will probably be impossible to keep all of the present system of aids in operation unless funds are provided.

SALARIES, KEEPERS OF LIGHTHOUSES.

For salaries of not exceeding 1,800 lighthouse and fog-signal keepers and persons attending other lights, exclusive of post lights, \$1,300,000.

NOTE.—This estimate is the same as the amount appropriated for the fiscal year 1922, and provides as follows:

1,400 keepers and assistant keepers, at average pay of \$840.....	\$1,234,800
Persons attending other lights.....	65,200
Total.....	1,300,000

SALARIES, LIGHTHOUSE VESSELS.

For salaries and wages of officers and crews of light vessels and lighthouse tenders, including temporary employment when necessary, \$1,800,000.

NOTE.—The amount estimated is \$70,000 less than the appropriation for the fiscal year 1922, and is arrived at as follows:

Authorized base pay, September, 1921.....	\$1,744,766
Longevity pay for unappointed men, at \$5 per month after 6 months' continuous service, and \$10 per month after 2 years' continuous service.....	69,600
Total.....	1,814,366

SALARIES, LIGHTHOUSE SERVICE.

For salaries of 17 superintendents of lighthouses and of assistant superintendents, clerks, draftsmen, and other authorized permanent employees in the district offices and depots of the Lighthouse Service, exclusive of those employed in the office of the Bureau of Lighthouses, District of Columbia: *Provided*, That the salaries of two superintendents of lighthouses shall not exceed \$5,500 each, of five shall not exceed \$5,000 each, of seven shall not exceed \$4,500 each, and of three shall not exceed \$4,000 each, \$460,000.

NOTE.—This estimate is \$60,000 more than the appropriation for 1922, but it is \$40,000 less than the estimate submitted for that year. This increase is due to urgent necessity for increasing the compensation of certain of the more responsible officers and employees in the lighthouse districts whose pay has been very inadequate for a number of years and who have received very little consideration in recent years. The compensation of these responsible and mostly technical positions is far too low in proportion not only to other Government services, but to other classes in the Lighthouse Service itself, who received war-time adjustments. The effect is demoralizing and is causing the more competent young men to seek other services. The increases affect only 106 persons, who have been selected as the most meritorious cases. The district superintendents of lighthouses especially are at present greatly underpaid in comparison with technical positions of similar responsibility in other branches of the Government and outside, and also in comparison with employees under their direction, many of whom are now receiving the same or greater compensation. A fair compensation for the district superintendents is extremely important for the future welfare of the Lighthouse Service. Any competent comparison of the responsibilities and qualifications of these positions will show that there certainly should be no discrimination against the district officers of the Lighthouse Service. The existing discrepancies of compensation are extreme and affect the morale of this service. The estimate includes only five additional positions—two watchmen, two draftsmen, and one radio expert—all of whom are necessary for the efficient conduct of the work.

Alternate Plan.

The following estimate of appropriation is submitted as an alternate plan to the foregoing six appropriations for the support of the Bureau of Lighthouses and the Lighthouse Service.

General expenses, Lighthouse Service.—For every expenditure requisite for and incident to the authorized work of the Lighthouse Service in carrying on the operation, maintenance, and betterment of aids to navigation, and of the premises, structures, and equipment connected therewith, on the rivers, sea, and lake coasts of the United States and territory under the jurisdiction of the United States, including the salaries and expenses of the office of the Bureau of Lighthouses in the District of

Columbia, and including the pay of persons retired under the act of June 20, 1918 (40 Stat., 608), and amendments thereto, \$8,032,000.

NOTE.—It is believed that by having maintenance appropriations in a single item a more economical and efficient administration of the Lighthouse Service can be effected. This consolidation of items would simplify the accounting system and permit the costs of work to be kept in a more systematic and comprehensive manner, showing clearly for each principal feature the relative amounts paid for salaries, materials, supplies, equipment, and other component items. The consolidation would permit the gradual carrying out of an important economy—in the installation of automatic unattended lights—as the amounts saved in services could be employed in the installation of additional equipment. Anomalies now existing as to the pay of similar classes of employees, as persons caring for minor lights and persons having to do with construction work, out of different appropriations, and pay and rations out of different appropriations, would be obviated. The language used at present in the appropriating words, in which an endeavor is made to specify particularly every item of expenditure, is becoming quite cumbersome. Should this method of appropriating for the support of the Lighthouse Service be adopted, it is estimated that a reduction of \$50,000 in the aggregate of maintenance appropriations may be made, as compared with the estimates submitted for separate items of appropriation, and the amount submitted above under this alternate plan, \$8,032,000, embodies such reduction.

RETIRED PAY, LIGHTHOUSE SERVICE.

For retired pay of officers and employees in the field service and on vessels of the Lighthouse Service, except persons continuously employed in district offices and shops, \$80,000.

NOTE.—The act of June 20, 1918, provides: "That hereafter all officers and employees engaged in the field service or on vessels of the Lighthouse Service, except persons continuously employed in district offices or shops, who shall have reached the age of sixty-five years, after having been thirty years in the active service of the Government, may, at their option, be retired from further performance of duty, and all such officers and employees who shall have reached the age of seventy years shall be compulsorily retired from further performance of duty: *Provided*, That the annual compensation of persons so retired shall be a sum equal to one-fortieth of the average annual pay received for the last five years of service for each year of active service in the Lighthouse Service or in a department or branch of the Government having a retirement system, not to exceed in any case thirty-fortieths of such average annual pay received: *Provided further*, That such retirement pay shall not include any amount on account of subsistence or other allowance." The amount required under this appropriation will necessarily increase gradually for a few years, as the number of persons annually becoming eligible to the benefit is greater than the number of retired employees who de cease. The appropriation for 1919 was \$30,000; for 1920, \$65,000; for 1921, \$71,000; for 1922, \$75,000; and \$80,000 is estimated for 1923. Eventually, however, the amount required will become practically stationary.

DETAILED ESTIMATES FOR SPECIAL WORKS, 1923.

GROUP No. 1.

Works urgently necessary for the safety or immediate needs of navigation and for the preservation of existing structures or equipment, for the full utilization of other public improvements or for the efficient equipment of the Lighthouse Service:

No. 1. *Lighthouse vessels, general service.*—Constructing or purchasing and equipping lighthouse tenders and light vessels for the Lighthouse Service, \$1,500,000.

NOTE.—The act of June 5, 1920 (41 Stat., 1058), authorized this work, and an appropriation of \$1,000,000 was made therefor by the act of March 4, 1921 (41 Stat., 1416). Under this appropriation contracts have been let for the construction of five light vessels. Careful estimates and examinations as to the condition and further serviceability of vessels of the Lighthouse Service show that it is very necessary to take prompt measures for replacing the older and worn-out vessels of the service. Immediate provisions should be made for 15 vessels (additional to those under construction) covered by this item. This is considered indispensable, not only to the efficient operation of the Lighthouse Service in the protection of shipping, but for the reasonable safeguarding of the lives of those employed on vessels of this service. The extent of the work required at this time is due to lack of sufficient appropriations for a number of years back to keep up a proper rebuilding program and to war conditions. Only one of the light vessels is for a new station, all the others being to replace vessels worn out in service. In view of the time required to design, contract for, build, and complete vessels funds to carry out this plan should be provided as rapidly as the work of construction can be accomplished, and \$1,500,000 is urgently needed to be appropriated at the next Congress. A full statement of this important need was given in Appendix A, Report of the Secretary of Commerce for 1919, and a further statement appears in this report at page 9. Detailed estimate:

Two tenders, at \$310,000.....	\$620,000
Four light vessels, at \$220,000.....	880,000
Total.....	1,500,000

No. 2. *Depot for fifth lighthouse district.*—Enlarging and improving the lighthouse depot at Portsmouth, Va., in the fifth lighthouse district, or establishing a new depot, \$275,000.

NOTE.—The act of June 20, 1918 (40 Stat., 607), authorized this work at \$275,000, but no appropriation was made therefor. The present lighthouse depot at Portsmouth, Va., is entirely inadequate to the needs of the fifth district, both in area and in water front. This depot is the principal supply station for the lighthouse work of Chesapeake Bay and the coast from Maryland to North Carolina, with the sounds and rivers. The increasing maritime and naval importance of the vicinity of Norfolk makes it urgent that a suitable depot be established promptly. It is the principal depot of one of the largest lighthouse districts and is the headquarters for six tenders and two light vessels during the greater part of the year. The aggregate length of these vessels is over 1,400 feet; the total wharf frontage is only 240 feet. The operation of tenders is much hampered by this limited frontage, the delay caused by waiting to discharge or receive cargo being estimated to cost the Lighthouse Service not less than \$35,000 a year. The very small area available for buoy storage necessitates much otherwise unnecessary handling of heavy buoys and append-

ages at large cost of time and money. The available wharf frontage of this depot should be doubled and the area increased by several acres. This may be done by purchase of a new and larger site, or by purchase of adjacent property. The present buildings are mainly antiquated wooden structures. They constitute a fire menace and should be replaced by modern fireproof buildings. While the detailed estimate given below shows a total estimated cost of \$400,000, in view of the possibility that a Government-owned site may be obtained, thus reducing the cost, appropriation is asked at this time for only the amount heretofore authorized by Congress. Detailed estimate:

Site, 500 feet water front, at \$250 per front foot.....	\$125,000
Wharf, at \$3.50 per square foot (50 by 700 feet).....	122,500
Track, at \$3.50 per linear foot (2,000 linear feet).....	7,000
Filling and grading, at \$3 per cubic yard (7,500 cubic yards).....	22,500
Concrete paving, at \$0.278 per square foot (90,000 square feet).....	25,000
Water mains in place, at \$3.50 per linear foot (1,000 linear feet).....	3,500
Electric lighting, power, wiring, and conduits.....	3,000
Traveling crane.....	8,000
Buoy skids and chain platform, at \$1 per square foot (50 by 160 feet).....	8,000
Miscellaneous equipment.....	7,500
Storehouse, at \$0.30 per cubic foot (100,000 cubic feet).....	30,000
Machine, blacksmith, and carpenter shop, at \$0.30 per cubic foot (60,000 cubic feet).....	18,000
Coal shed, at \$0.25 per cubic foot (80,000 cubic feet).....	20,000
Total.....	400,000

No. 3. Delaware Bay entrance, aids to navigation.—Improving the aids to navigation at the entrance to Delaware Bay, \$138,000.

NOTE.—The act of June 5, 1920 (41 Stat., 1058), authorized this work in the sum of \$148,500, but no appropriation was made therefor. In consequence of the continued erosion of the shore line in the vicinity of Cape Henlopen Light Station, Delaware, the drift southwestward of the sand dune on which the tower is situated, and the impossibility of economically holding the reservation with protective works much longer, the early abandonment of this station is probable. Careful study of the aids to navigation at the entrance to Delaware Bay indicates that in the event of the discontinuance of the present Cape Henlopen Light the needs of navigation at this important entrance can be fully met by improving, protecting, and adding to the other aids in the vicinity. The most important of these—the Harbor of Refuge Light and Fog-Signal Station on the southern end of the outer breakwater—is urgently in need of additional riprap protection and other repairs and remodeling, as it was seriously damaged by severe storms of the past winter. The fog-signal plant is old and in need of renewal and improvement. At Brandywine Shoal additional riprap is required and an armored belt at the water line to take the impact of ice and movements of the riprap in storms. Some general repairs to the wharf of the old station close by are desirable, as it is very useful as a landing platform, etc. A whistling buoy on the southern outer end of the Hen and Chickens Shoal is necessary for coastwise traffic, especially in thick weather. In case of the abandonment of the old light at Cape Henlopen it is proposed to place a steel tower with automatic light on the sand dune to take the place of the present station and keepers. Detailed estimate:

5,500 tons riprap at Harbor of Refuge, at \$12.....	\$66,000
6 cubic yards concrete filling, Harbor Refuge floor, at \$25.....	150
Rearranging and improving fog signal at Harbor of Refuge Station.....	10,000
General repairs to the Harbor of Refuge Station.....	6,000
Semicircular parapet of flaring plates on seaward side of Harbor of Refuge Lighthouse, 25,000 pounds, at 28 cents, or other efficient means of protection against the waves.....	7,000
1,500 tons riprap at Brandywine Shoal Light Station, at \$12.....	18,000
Armor belt of steel plates about the water line of Brandywine Shoal Station pier, 25,000 pounds, at 22 cents.....	5,500
General repairs to deck and timbers of old wharf, about the old Brandywine Shoal Station, 50 M feet, at \$125.....	6,250
Whistling buoy, outer end Hen and Chickens Shoal, with moorings and relief buoy with moorings.....	5,000
Steel tower for Cape Henlopen, 60 feet high.....	4,000
375 millimeter lantern, tanks, and piping for 60-foot tower.....	3,300
Contingencies, about 5 per cent.....	6,800
Total.....	138,000

No. 4. Aids to navigation, Alaska.—Establishing new aids to navigation and for improvements to existing aids in Alaska, \$125,000.

NOTE.—An appropriation of \$75,000 was made by the act of July 19, 1919 (41 Stat., 213), for aids to navigation in Alaska, but practically all of this has been obligated and maritime interests are urging that the system of lights and fog signals be further improved to facilitate and safeguard water transportation in Alaska, where navigation is exceptionally difficult and hazardous, as shown by the frequency of costly marine disasters occurring in these waters. There are comparatively few fog signals in Alaska in the past 15 years. On account of the great amount of stormy and foggy weather, the dangers to which vessels are exposed in these channels, and the scarcity of favorable anchorage a number of powerful fog signals should be provided as early as practicable, and the effectiveness of some of the earlier fog signals should be improved, and this item provides for two of these. A number of watched lights on shore or on reefs and a few lighted buoys are needed to mark the principal routes of navigation through the inside passages, and a number of requests have been received for lights to mark the entrance to bays where fish-packing or other plants are located. A few unwatched lights are needed on the outside coast to mark headlands or entrances to harbors for the benefit of coastwise traffic and fishing vessels. At Guard Island, an important station on the principal inside route, at the westerly end of Tongass Narrows, it is desired to replace the present unsatisfactory fog bell with an air diaphone and to construct a suitable permanent building for the light and fog signal to replace present temporary wooden tower; also, to erect another dwelling in order that two keepers may be assigned instead of one, as at present, and thus provide for continuous night and day watches. At Point Retreat, an important station, there is now only an unwatched acetylene light and no fog signal. All regular vessels plying between southeastern and southwestern Alaska pass this point, either by way of Saginaw Channel or by way of Skagway and Lynn Canal. It is proposed to establish an air diaphone and assign keepers, a suitable structure to be erected for the light and fog signal, and an unused dwelling now at the station to be repaired and refurnished for the use of keepers. Revised estimates indicate that the amount of \$32,500 authorized by act of June 5, 1920 (41 Stat., 1059), for Point Retreat and Cape Hinchinbrook will be insufficient to cover the cost of necessary improvements at Point Retreat alone. The estimates heretofore submitted for improvements to aids

in Alaska contemplated doing the work at Point Retreat in conjunction with similar work at Guard Island, the same equipment, organization, etc., to be used at both stations, thus reducing the cost of each. Detailed estimate:

Guard Island Light and Fog-Signal Station:

Fog-signal building and light tower surmounting same, reinforced concrete with metal lantern, at \$2.15 per cubic foot (13,000 cubic feet).....	\$27,950
Dwelling for keeper, frame, one-story and attic, with concrete foundation, at 44 cents per cubic foot (20,000 cubic feet).....	8,800
Lantern and illuminating apparatus, lot.....	2,750
Engines, compressors, and accessories.....	2,500
	<hr/>
	42,000

Point Retreat Light and Fog-Signal Station:

Fog-signal building and light tower surmounting same, reinforced concrete with metal lantern, at \$2.15 per cubic foot (13,000 cubic feet).....	27,950
Repairs to existing dwelling.....	4,000
Minor structures.....	2,000
Boats, 3, at \$600 average.....	1,800
Lantern and illuminating apparatus, lot.....	2,750
Engines, compressors, and accessories.....	2,500
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	41,000

Gas buoys, at \$5,100 each (2).....	10,200
Automatic acetylene lights, at \$4,000 each (2).....	8,000
Automatic acetylene lights, at \$2,000 each (6).....	12,000
Automatic acetylene lights, at \$1,300 each (6).....	7,800
Automatic acetylene lights, at \$800 each (5).....	4,000
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	42,000

Grand total..... 125,000

No. 5. Calumet Harbor, Ill., aids to navigation.—Improving aids to navigation in Calumet Harbor and Calumet Pierhead Light Station, Illinois, \$66,000.

NOTE.—Calumet Harbor Light and Fog-Signal Station is located at the outer end of the Calumet Harbor (South Chicago) Breakwater. It is a steel structure with brick lining, having a second story and roof of wooden-form construction. The building stands on a number of small concrete columns bedded into the stone filling of the timber crib breakwater. The timber superstructure of the breakwater is old and advanced in decay. In April, 1920, two very heavy northeasterly storms "shook up" the station so badly and "worked" underpinning so severely that the keepers became badly scared in regard to their safety. The United States engineers have begun the entire rebuilding of the timber superstructure of breakwater in concrete and propose to rebuild the entire breakwater as fast as funds are made available. The breakwater has a length of about 6,800 feet. Permanent repairs must be begun immediately if the station is to be made safe and kept in commission. Calumet Harbor is one of the most important on Lake Michigan, the arrivals and departures of vessels per year being about 2,300, having a net registered tonnage of over 9,000,000, value of receipts and shipments per year being about \$125,000,000. The importance of this commerce fully justifies maintaining the aids in most efficient condition. The fog signal is operated more hours than any other signal on Lake Michigan. The present equipment, of oil engines and air siren, is old, very noisy, and becoming obsolete and should be replaced in the near future by modern and more efficient equipment. It is proposed to construct a hollow, strongly reinforced concrete foundation pier (providing a basement within same) having a height of about 15 feet above lake level, to stand in present site on the present underwater portion of timber cribs of the breakwater; a switch house to be built at inner end of the breakwater and connected with station or outer end by electric power cable along top of breakwater. Duplicate diaphone fog signal and a submarine signal operated by electric power are to be installed; electric light to be used for illumination of lens. At Calumet Pierhead Light Station, where there is a small cast-iron tower equipped with oil light and hand-power fog bell and maintained by two keepers, it is proposed to install an electric-operated diaphone and place electric lights in lens and to discontinue the services of the two keepers now employed at this station, the station then to be operated by remote electric control from the harbor station. Detailed estimate:

Moving present steel building.....	\$3,000
Removing old timber superstructure of breakwater, 30 by 100 by 6 feet high (704 cubic yards, at \$5 per cubic yard).....	3,520
Reinforced concrete hollow superstructure for breakwater, 30 by 100 by 6 feet high (704 cubic yards, at \$25 per cubic yard).....	17,600
Reinforced concrete foundation pier on top of above, 30 by 68 by 10 feet high, walls 24 inches thick (206 cubic yards, at \$40 per cubic yard).....	8,240
Repairing and altering old steel structure and frame second story and roof.....	5,000
	<hr/>
	37,360
Steel switch house on shore.....	300
Fog-signal apparatus, including electric transmission.....	17,830
Submarine fog signal.....	3,000
Electric illuminating equipment in place of old lens.....	100

Total for Calumet Harbor..... 58,500

Calumet Pierhead (North) Light Station:

Fog-signal apparatus, including transmission and installation.....	7,410
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Grand total..... 66,000

No. 6. Spectacle Reef Light Station, Michigan.—Completing improvements to Spectacle Reef Light Station, Michigan, \$14,500.

NOTE.—The act of July 1, 1918 (40 Stat., 683), appropriated \$23,000 for improvements to Spectacle Reef Light Station, Michigan. The work was not started until the present season owing to the extremely high prices of labor and material which have prevailed, making it practically certain that the work could not

be completed within the amount of the original appropriation. The work has now been started with a view to completing the most necessary work from funds now available. It is estimated that the additional amount above stated will be necessary to complete the entire work. The work consists in repairing the largest concrete pier, 90 feet square, surrounding the lighthouse at the water line, where it has been badly eroded by ice and sea action, in some places having been cut into as much as 4 feet. It is very expensive work, involving much diving and a large contingency due to the exposed location. Detailed estimate:

Concrete, 500 cubic yards, at \$37.....	\$18,500
Reinforcing steel in place, 8,000 pounds, at 6 cents.....	480
Bolts and fastenings, 29,000 pounds, at 10 cents.....	2,900
Expansion fastenings.....	1,750
Structural steel members, plate anchors, etc.....	1,600
Labor placing bolts, etc.....	6,270
Steel ice protection in place.....	5,000
Incidentals and contingencies.....	6,000
Total.....	42,500
Less appropriation made by act of July 1, 1918.....	28,000
Amount required.....	14,500

No. 7. Cape Spencer Light Station, Alaska.—Establishing a light and fog signal station at or near Cape Spencer, Alaska, \$175,000.

NOTE.—Cape Spencer is at the entrance to Cross Sound and Icy Strait, through which pass all vessels running between Puget Sound ports and Prince William Sound, Seward, Cook Inlet, and Kodiak, excepting only occasional freighters proceeding by outside route. Traffic by way of Cape Spencer is materially increasing owing to work on the Government railroad, which will probably be completed within the next two years, and the consequent development of southern and southwestern Alaska. A small unwatched light is now maintained on the Cape, but a more powerful watched light and a fog signal of the first class should be provided. A landfall must be made in this vicinity by all vessels returning from the westward, and as the entrance to Cross Sound is difficult to make, especially in thick weather, it is important they be given all the assistance possible. Maritime interests are urging the establishment of this aid as their most important need in Alaska. Detailed estimate:

Construction plant, including wharf and storehouse.....	\$17,000
Transportation of men and materials.....	15,000
Tower, including fog-signal building and living quarters for keepers, at \$1.30 per cubic foot (65,000 cubic feet).....	84,500
Lantern, watch room, and other metal work, at 24 cents per pound (83,500 pounds).....	20,040
Boathouse, at 25 cents per cubic foot (9,600 cubic feet).....	2,400
Hoist houses, hoists, and derrick, lot.....	9,560
Illuminating apparatus, lot.....	13,500
Fog signal, lot.....	13,000
Total.....	175,000

No. 8. Newport Lighthouse Depot, Rhode Island.—Purchasing site and building wharf and storehouse for new lighthouse depot in Narragansett Bay, same to be located at Newport, R. I., or vicinity, \$82,300.

NOTE.—This depot is used to supply the eastern end of the third lighthouse district, including Narragansett Bay. The present depot is located on the breakwater at Newport Harbor, which location is very unsatisfactory and inconvenient, as the water at the dock is too shoal for the larger tenders, and there are no facilities for tenders getting water or having provisions, ice, etc., delivered, which necessitates the tenders going to Newport for provisions, etc., causing much waste of working hours. The Navy Department is building along the breakwater continuously, and the present plans of the Navy bring them down to the lighthouse depot. The present dock is in very bad condition, due to age, decay, and worming of piles, and at present is unsafe for further use. Improvement of the depot on existing site is not considered economical, owing to lack of space and other conditions. Detailed estimate:

Site for new depot.....	\$40,000
Piling, 300 piles, at \$80 each.....	24,000
Concrete dock, 350 cubic yards, at \$30 per cubic yard.....	10,500
20,000 feet timber, at \$165 per 1,000 board feet.....	3,300
Storehouse, 15,000 cubic feet, at 30 cents per cubic foot.....	4,500
Total.....	82,300

No. 9. Radio fog-signal installations.—Installation and development of radio fog signals at or near lighthouses and light vessels, \$50,000.

NOTE.—The greatest need at the present time for increasing the safety of navigation is for more efficient fog signals. The development of radio apparatus and of means of accurately obtaining the direction of radio signals with the radio compass prove that radio apparatus is of great value for the location of ships in fog, thick weather, or beyond the range of visible signals. This item is for the purpose of further applying radio signals to this important work of the Lighthouse Service. This apparatus consists of a radio-sending station at a lighthouse on shore or on a light vessel at sea from which definite signals are sent out at regular intervals in the same manner as from a whistle or bell. The signals are, however, picked up on shipboard by means of a radio compass, an instrument which gives the direction of the source of the radio signal. By obtaining such signals from two or more known points the intersection of such directions may be plotted on a chart, thus giving the correct position of the ship at sea. A single signal may also be used as a leading mark for which to steer. The Lighthouse Service, in collaboration with the Bureau of Standards, has been investigating this method since 1916, with two years' interruption on account of the war. Sending sets have been established in Ambrose Channel and Fire Island light vessels and Sea Girt Light Steamer, in the vicinity of New York Harbor, and a radio compass has been installed in the light-house steamer *Tulip*. The tests which have been made prove the practicability of this means of navigation, by which a navigator may determine the position of his vessel with certainty within the range of audibility of the sending stations, which at present is from 60 to 200 miles. This system has many advantages, some of which are: (1) It is capable of easy installation and operation without any additional personnel; (2) it requires no knowledge of radio apparatus or the telegraph code for its use; (3) any number of

vessels at sea may obtain their position without interference in the minimum amount of time; (4) it permits the navigator to take his own bearings without depending on others for accuracy, thus placing the responsibility for the safe navigation of the vessel where it properly belongs. It is proposed to establish radio direction signal stations at the most important harbor entrances and other prominent points on the Atlantic and Pacific coasts. Detailed estimate:

Installation of seven stations, at \$7,000.....	\$49,000
Contingencies.....	1,000
Total.....	50,000

No. 10. *Lighthouse depot, Detroit, Mich.*—Completing the improvements to the Detroit Lighthouse Depot, \$50,000.

NOTE.—The act of July 1, 1918 (40 Stat., 696), appropriated \$53,000 for improvements at the lighthouse depot, but, on account of the great advance in cost of labor and materials, it is impracticable to complete the work estimated within the amount appropriated. It is estimated that \$34,500 additional is required to complete the work. The outer section of the wharf has been practically completed, as well as the addition to the lamp shop building. All mechanical equipment for the latter is yet to be supplied. The entire inner section or causeway portion of the wharf is yet to be completed. It is very essential that this connecting portion of the wharf be completed at the earliest practicable date in order that the portion already completed may be fully utilized. It is also urgently necessary that dredging be done to give the full depth of water over the basin area. Additional improvements to the depot, consisting of the construction of a retaining wall along Mount Elliott Avenue and the closing in of the present open buoy shed to serve as a fabricating shop for steel work, etc., should be carried out at the same time the dock work and equipment of lamp shop is done. Detailed estimate:

Wharf, 19,900 square feet, at \$3.30 per square foot.....	\$65,670
Dredging, 3,400 cubic yards, at \$1 per cubic yard.....	3,400
Mooring bollards (9) at \$60 each.....	540
Steel track, 600 linear feet, at \$1.50 per linear foot.....	900
Water supply, electric work, etc.....	490
Lamp shop, 27,000 cubic feet, at \$0.50 per cubic foot.....	13,500
Retaining wall, 500 linear feet, at \$5 per linear foot.....	2,500
Alterations to buoy shed for shop.....	2,500
Machinery and equipment.....	8,000
Contingencies.....	5,500
	103,000
Less appropriation made by act of July 1, 1918.....	53,000
Total.....	50,000

No. 11. *Detroit River, Mich., patrol boat.*—The Secretary of Commerce is authorized to expend not to exceed \$25,000 of the unexpended balance of the appropriation of \$210,000, made for establishing aids to navigation along the Livingstone Channel, Detroit River, Mich., including authority to locate and construct lights and place buoys necessary to mark this channel (act approved Mar. 4, 1911; 36 Stat., 1431), for the construction, or purchase, and equipment of a suitable patrol boat for tending the aids to navigation in said channel and adjacent waters.

NOTE.—Under the act of March 4, 1911 (36 Stat., 1431), a system of lights and buoys has been established to aid navigation in the Livingstone Channel, Detroit River, Mich. These aids are now completed, and a balance of \$59,000 remains unexpended from the appropriation made for this purpose. These aids need a considerable amount of attention, and to maintain them properly a special boat to be devoted almost exclusively to this work is necessary. Heretofore an old launch that has been in the service 12 years has been used for tending these aids, but it is now practically unserviceable, and also it is not large enough for the requisite carrying and hoisting capacity. It is estimated that a suitable small tender can be obtained for \$25,000, and it is recommended that authority be granted to expend this amount from the appropriation made for establishing the aids, no additional appropriation by Congress being needed.

No. 12. *Raritan Bay and connected waters, N. Y. and N. J.*—Establishing and improving aids to navigation in Princess Bay dredged channel, Raritan Bay, Arthur Kill, South Amboy dredged channel, and Raritan River, N. Y. and N. J., \$100,000.

NOTE.—The present Princess Bay Light Station, established many years ago, is of practically no use in assisting the present-day deep-water traffic through the narrow channels in this vicinity. The channels in Raritan Bay, Arthur Kill, and South Amboy are narrow and crooked, and there are no lights to mark the entrances or turns in the channels, the only aids being unlighted buoys, which makes night navigation very difficult, and as both the light and deep-draft traffic is heavy and is increasing rapidly a more extensive and efficient system of aids is necessary. At the present time this service has three acetylene lights in Raritan River, all located in the lower end of the river, which leaves the upper end without any lights or aids. As the river channel is narrow and crooked and river banks low, night navigation in this river beyond existing lights is next to impossible. The navigation on and business along this river has increased greatly during the past few years, and the six additional lights are very necessary. The four new lights in Princess Bay dredged channel, Raritan Bay, the two at Storys Flats in Arthur Kill, and one in South Amboy dredged channel are to be unwatched flashing acetylene lights with steel towers located on riprap and concrete foundations. The six new lights in Raritan River are to be unwatched flashing acetylene lights with steel towers and concrete foundations located on the dikes and river banks. Detailed estimate:

Riprap, 17,500 tons at \$4 per ton in place.....	\$70,000.00
Acetylene tanks (105), at \$120.70 each.....	12,673.50
200-millimeter acetylene lanterns (12), at \$124 each.....	1,488.00
375-millimeter acetylene lantern.....	780.00
Acetylene flashers (13), at \$160 each.....	2,080.00
18-foot steel towers (12), at \$350 each.....	4,200.00
30-foot steel tower.....	425.00

Steel tubing, 1,300 feet, at \$0.17 per foot	\$221.00
Manifolds, gauges, valves, and installing flashers, piping, etc.	1,040.00
Concrete, 900 cubic yards, at \$12 per cubic yard	11,520.00
Unforeseen and minor items.....	3,600.00
Total.....	108,027.50

No. 13. *Galveston Bay and Houston Channel, Tex., aids to navigation.*—Improving existing aids to navigation and establishing new aids in Galveston Harbor and Bay and along the Houston Channel in Galveston Bay from Bolivar Roads to Morgan Point, Tex.; \$125,000.

NOTE.—The oil gas buoys now in service in Galveston Bay are very old, of an obsolete type, and unreliable and unsatisfactory to maritime interests. The commerce of Galveston, Texas City, and Houston is very large. The exports and imports of Galveston alone during the year 1920 were approximately \$955,496,462. The shipping out of Texas is large and important. The commerce of the Port of Houston is assuming great importance, and the improvement of the channel, including work now authorized, will represent an expenditure of over \$10,000,000. Therefore, this amount is imperatively required in order to properly mark the channels leading to the three important ports in question. Detailed estimate:

Gas and bell buoys (18), at \$4,562.....	\$82,106
Chain, ballast balls, and other moorings.....	7,894
Building 13 compressed acetylene lights in water: Minor lights, pyramidal structure, 66½ cents per cubic foot (5,769 cubic feet each, 75,000 cubic feet in all).....	50,000
Constructing or purchasing a suitable patrol boat for tending aids to navigation in Galveston Bay and Houston Channel.....	15,000
Total.....	155,000

No. 14. *Hawaiian Islands Lighthouse Depot.*—Constructing and equipping a lighthouse depot at Honolulu, Hawaii, \$120,000.

NOTE.—The act of June 5, 1920 (41 Stat., 1059), increased the authorization for this work from \$90,000 to \$120,000, but no appropriation was made therefor. The greatest need in this district is an adequate lighthouse depot. At present the depot is in a temporary rented building, costing \$110 per month, and is subject to vacating on 90 days' notice. This building is about one-third mile from lighthouse wharf, which results in considerable cartage expenses. The present location and building are not suitable for a lighthouse depot. The building is on the lee side of a dusty street, and it is impossible to keep out great quantities of dust. The tenure of this building is very uncertain, and on account of the scarcity of storage room in Honolulu there is no certainty that another storehouse as suitable as this one could be rented even at a high rate. The Lighthouse Service now has the necessary sites for its proposed depot in this district, consisting of half a slip and a small wharf in Honolulu; also, 1½ acres on Sand Island across the harbor, which is to be utilized for a buoy depot if needed at a later date. Water and land borings at lighthouse wharf were completed July 6, 1921, and work on preliminary plans will be prepared in the near future. It is proposed to build the present wharf out to the "140-foot" slip line and extend it to the total length of 330 feet, making a total area of about 20,750 square feet, about half of which would be a reinforced concrete wharf on piles. General storehouse, machine and repair shop, oil house, and storage of buoys are to be located on this wharf. With the reduced number of spare buoys in this district, the size wharf here proposed would be large enough to take care of present and near future needs. Detailed estimate:

Excavation and fill, 1,000 cubic yards, at \$2.....	\$2,000
Retaining wall, reinforced concrete (1½ by 4), 155 linear feet, at \$8.....	1,240
Sea wall, reinforced concrete (2½ by 8), 275 linear feet, at \$35.....	9,625
Water and waste pipe (furnish, lay, cover), 600 linear feet, at \$2.25.....	1,350
Improvement old wharf, grading, and concrete paving, 500 square feet, at 70 cents	3,150
New reinforced concrete wharf on piles, 10,800 square feet, at \$3.60.....	38,880
General storehouse, reinforced concrete and tiling, 75,000 cubic feet, at 53 cents.....	39,750
Machine and blacksmith shop, reinforced concrete, 12,500 cubic feet, at 53 cents	6,625
Buoy repair and carpenter shop sheds, 2,500 square feet, at \$2.....	5,000
Equipment, general depot and buoy shed.....	2,000
Equipment, machine, carpenter, and blacksmith shop, lot.....	6,500
Electric wiring, \$500; fire protection, \$600	1,100
Improvement to reservation.....	530
Oil house, 7,500 cubic feet, at 30 cents.....	2,250
Total.....	120,000

No. 15. *Depot for seventh lighthouse district.*—Purchasing site for and constructing and equipping a lighthouse depot for the seventh lighthouse district, \$225,000.

NOTE.—The act of June 5, 1920 (Pub. No. 275—68th Cong.), authorized this work, but no appropriation was made therefor. The Lighthouse Service storehouse, wooden smithy, and wharf are on property belonging to the Treasury Department, which is situated in the midst of the United States naval station. The wooden storehouse and wharf, which are highly inflammable, are located between the Navy coal sheds and Piers A and B, one of each on each side, and are therefore in an unusually dirty location. The coal dust is practically always in motion, and when the coal conveyors are in operation it blows about in clouds. It finds its way into the depot keeper's quarters and into the storehouse, where thousands of dollars' worth of property is stored, which it is impossible to keep clean. These coal sheds have been erected since the storehouse was built. Furthermore, there are frequently several Navy torpedo-boat destroyers lying alongside at the Navy piers on each side of the depot wharf, which, in addition to causing a great deal of dirt, are a menace to the lighthouse tenders on account of collision. A new site and wharf are now urgently needed for the efficient and economical work of the district. The Navy Department has repeatedly urged the removal of this depot from its present location in the midst of the navy yard. Detailed estimate:

Site, water-front property, about 100,000 square feet, at \$1.25 per square foot	\$125,000
Wharf, at \$2.15 per square foot (30 by 400 feet).....	25,800
Bulkheading, at \$30 per linear foot (400 by 27 by 1 foot).....	12,000
Service building, at 44 cents per cubic foot (70,000 cubic feet).....	30,800
Keeper's dwelling, at 37 cents per cubic foot (24,000 cubic feet).....	8,880
Storehouse, at 18 cents per cubic foot (144,000 cubic feet).....	25,920
Oil house, at 28 cents per cubic foot (8,000 cubic feet).....	2,240

Machine shop, at 19 cents per cubic foot (12,000 cubic feet).....	\$2,280
Carpenter shop, at 19 cents per cubic foot (12,000 cubic feet).....	2,280
Blacksmith shop, at 19 cents per cubic foot (12,000 cubic feet).....	2,280
Track on wharf, at \$1.80 per linear foot (2,400 linear feet).....	4,320
Buoy skids and chain platform, at \$1.50 per square foot (25 by 40 feet).....	1,500
Boundary fence, at \$3.50 per linear foot (680 linear feet).....	2,380
Water pipe (excavating, furnishing, laying, and covering), at \$1.55 per linear foot (280 linear feet).....	434
Shop equipment.....	3,886
Total.....	250,000

No. 16. *Potomac River, Md., aids to navigation.*—Improving the aids to navigation and establishing new aids on the Potomac River, Md., \$90,000.

NOTE.—The act of June 20, 1918 (40 Stat., 608), authorized this work, but no appropriation was made therefor. The Potomac River is the most poorly lighted and marked of the important navigable rivers of the United States, a condition which should not be allowed to continue, because of its relation to the National Capital and many Government activities, and its increased navigational importance. There are urgent requests from steamship companies for improvements in the lighting and marking of the Potomac River. The Potomac River from Maryland Point to Washington, about 40 nautical miles, is now lighted by only four gas buoys, five minor lights, and one lighthouse. The gas buoys are of low candlepower and are of necessity removed from station for several months in the winter on account of ice conditions. The minor lights are all fixed white or red lights of low candlepower, located on wharves or on timber structures, which are liable to destruction by ice in the winter. Jones Point Light Station is of little use on account of changes in shoreline at this point. It is proposed to establish nine lights, nine fog signals, move one light, change two fog signals from bells to horns, change two spar buoys to tall-type cans, replace one spar buoy with a bell buoy, establish a gas buoy, and convert seven oil gas buoys to acetylene gas buoys. Jones Point Light Station and the five minor lights above mentioned may then be discontinued. Detailed estimate:

Site for 1 light station, 3 acres, at \$333.33.....	\$1,000
1 dwelling, 30 by 40 feet, frame, 14,286 cubic feet, at \$0.35 per cubic foot.....	5,000
6 light towers, frame, 20 feet high, 6,000 cubic feet, at \$0.30 per cubic foot.....	1,800
1 light tower, iron pipe, 25 feet high.....	710
2 fog-signal houses, 15 by 20 by 8 feet, brick, 4,800 cubic feet, at \$0.50 per cubic foot.....	2,400
6 fog-signal houses, at \$100 each.....	600
1 fog-signal tower, 2,000 cubic feet, at \$0.30 per cubic foot.....	600
Illuminating apparatus for 9 stations.....	7,750
Fog-signal apparatus for 11 stations.....	20,600
Transfer of one tower.....	100
Two light stations on caissons, cast iron filled with concrete:	
Steel-sheet submarine stations, 26,000 pounds, at \$0.25 per pound.....	6,500
Cast-iron submarine stations, 25,000 pounds, at \$0.15 per pound.....	3,750
Concrete submarine stations, 260 cubic yards, at \$35 per cubic yard.....	9,100
Piling, staging, erecting.....	5,300
Towers, hardware, etc.....	850
Riprap, 1,200 tons, at \$12 per ton.....	14,400
Buoys, 2 tall cans, at \$500 each.....	1,000
Buoy, one gas.....	4,400
Buoy, one bell.....	1,200
Chain, sinkers, shackles, and swivels for buoys.....	2,900
Total.....	90,000

No. 17. *Depot for eighth lighthouse district.*—Constructing and equipping a lighthouse depot for the eighth lighthouse district, at New Orleans, La., or vicinity, \$132,750.

NOTE.—The act of June 20, 1918 (40 Stat., 608), authorized this work in the sum of \$88,500, but no appropriation was made therefor. A lighthouse depot at New Orleans, La., is of great importance for the convenient and economical administration of the district. It should be at district headquarters, where supplies and materials are readily available and where shipments by rail and steamer could be received and accumulated for distribution by tender or other means at the proper time. The lamp shop should be located at this depot, as at present all intercourse with the mechanic in charge is by mail and telegraph, which is an inefficient method and the cause of numerous delays, and the present quarters are crowded, inadequate, and badly located. The stores and supplies, excluding buoys and appendages, should be under the eye of the superintendent at all times. The present depot at Port Eads, La., at the South Pass of the Mississippi River, is nearly 100 miles from district headquarters. A desirable site has been secured for the proposed depot, through a permit from the Treasury Department, to use a portion of the river frontage outside of the levee at the Marine Hospital, New Orleans, La. Material increase in the cost of labor and materials, notwithstanding some recent decreases, necessitates an increase over the original estimate for this project which was submitted in 1917. Detailed estimates:

Wharves on creosoted piles and stringers, at \$1.50 per square foot (60,000 square feet).....	\$90,000
Steel shed on wharf, at \$1.50 per square foot (18,000 square feet).....	27,000
Lamp shop, blacksmith shop, oil house, at 52½ cents per cubic foot (30,000 cubic feet).....	15,750
Total.....	132,750

No. 18. *Charleston Lighthouse Depot, South Carolina.*—Completing the lighthouse depot at Charleston, S. C., in the sixth lighthouse district, \$60,000.

NOTE.—The act of July 5, 1920 (41 Stat., 1058), authorized this work, but no appropriation was made for it. The act of October 22, 1913 (38 Stat., 244), appropriated \$125,000 toward the purchase of a site and construction of a wharf and buildings and equipment, so far as funds might permit, for a depot for the sixth district. This entire appropriation has been expended, but all the necessary facilities have not been provided. The site itself cost \$60,000 and the wharf \$46,418. Further requirements to complete the depot include repairs to old dwelling or construction of new dwellings for the keeper and assistant keeper, who are required to live on the reservation, additional filling, dredging around wharf, sewer system, walks, roads, oil house, blacksmith shop, additional equipment, etc. A considerable portion of the grounds is now below or only slightly above high water and should be filled to make it available for use. The wharf is overcrowded with spare buoys and buoys awaiting repairs. A portion of the grounds adjacent to the shops should be paved to afford a suitable storage space for these buoys. This project should be completed to

enable the district organization to perform its duties more efficiently. In conformity with a policy of rigid economy it provides for repairing an old dwelling house for the two keepers and their families, instead of constructing two new houses for them. Detailed estimate:

Filling and grading, 5,500 cubic yards, at \$2.05 per cubic yard.....	\$11,275
Keepers' dwelling, relocate and repair present dwelling.....	5,500
Buoy storage space, including curbing, 3,000 square feet, at \$2.80 per square foot.....	8,400
Oil house on pile foundation, 10,500 cubic feet, at 53 cents per cubic foot.....	5,565
Carpenter shop, converting present temporary oil house.....	2,300
Blacksmith shop, steel, 15,000 cubic feet, at 23.5 cents per cubic foot.....	3,525
Water mains, sewer, roads, fence, etc.....	11,400
Fire protection, sprinkler system, 2,000 linear feet, at \$1.20 per foot.....	2,400
Equipment for machine, carpenter, and blacksmith shops.....	5,000
Electric lighting extension of present system.....	1,500
Railroad track, 500 linear feet, at \$1 per foot.....	500
Dredging, 8,000 cubic yards, at 30 cents per cubic yard.....	2,400
Garage, convert and relocate present temporary blacksmith shop.....	300
Platform scale, 20-ton.....	1,000
Contingencies.....	475
Total.....	60,000

No. 19. *Virgin Islands, West Indies, aids to navigation.*—Establishing and improving aids to navigation in the Virgin Islands of the United States and adjacent waters, West Indies, \$50,000.

NOTE.—The act of June 30, 1918 (40 Stat., 608), authorized this work, but no appropriation was made therefor. By Executive order of July 30, 1917, the lighthouse service in the Virgin Islands, West Indies, acquired by the United States by treaty from Denmark, was transferred to and placed under the jurisdiction of the United States Lighthouse Service. The aids to navigation in these islands are not extensive and will require additions and improvements to make the waters safe and to provide for increasing commerce. It is proposed to provide four unwatched gas lights, five new buoys, as well as additional aids as may be necessary after further study and developments, and to place existing lighthouse property in a good condition of repair. The governor of the Virgin Islands, on July 15, 1919, wrote the Secretary of Commerce urging the importance of improvement of aids to navigation in the Virgin Islands. Detailed estimate:

4 unwatched lights, tower 25 feet high, at \$5,000 each.....	\$20,000
5 buoys with moorings, at \$1,000 each.....	5,000
Relief and spare equipment for lights and buoys.....	5,000
Repairs to existing property.....	10,000
Additional aids to navigation, as necessary.....	10,000
Total.....	50,000

No. 20. *Ludington, Mich., aids to navigation.*—Improving aids to navigation and establishing new aids at Ludington, Mich., \$70,000.

NOTE.—The act of June 5, 1920 (Pub. No. 275, 66th Cong.,) authorized this work in the sum of \$50,000, but no appropriation was made therefor. Owing to increased costs since the estimate on which that authorization was based was submitted this amount is not now sufficient for the necessary work. The present location of the fog-signal station on the end of south pier is 1,500 feet inside of entrance to outer harbor. At present the actual entrance between the breakwaters must be found by feeling around in the fog. This subjects vessels to danger of striking the breakwater. The commerce of Ludington, which includes important car-ferry lines across Lake Michigan, is as important as any other port on the east shore of Lake Michigan, and as this port is very inadequately lighted now this improvement is considered well warranted. It is proposed to establish a main light on the outer end of the north breakwater, with fog-signal apparatus, consisting of electrically driven air compressor and compressed air fog signal with oil engine reserve drive, and to discontinue the present steam fog signal in old wooden structure. Quarters for keepers are to be erected adjacent to the light, as it is unsafe to cross the harbor during the winter and when the ice is constantly broken up by car ferries. The present dangerous condition should be corrected as early as practicable. Authorization of this item in the increased amount estimated is pending in House bill 6915 (67th Cong., 1st sess.) but has not been enacted. Detailed estimate:

North Breakwater (main light):	
Reinforced concrete foundation, approximately 24 by 24 feet by 20 inches high, 427 cubic yards, at \$30 per cubic yard.....	\$12,810
Steel tower, concrete lined, base 15 feet square, top 10 feet square, 40 feet high, 6,480 cubic feet, at \$1.25 per cubic foot.....	8,100
Cast-iron lantern house, fourth order.....	1,900
Fog-signal house, brick and tile, 18 by 33 by 14 feet, at 60 cents per cubic foot (8,500 cubic feet).....	5,100
Foundation for fog-signal house, 60 cubic yards concrete, at \$12 per cubic yard.....	720
Fog-signal apparatus.....	17,770
Illuminating apparatus, fourth-order lens with electric light.....	2,500
Total, North Breakwater.....	48,900
South pier:	
Concrete foundation.....	600
31 foot steel tower.....	400
North pier:	
Concrete foundation, 30 cubic yards, at \$20 per cubic yard.....	600
31-foot skeleton tower.....	1,200
1,000-foot electric transmission pole line.....	500
300-millimeter lens lantern and electric light.....	300
Keepers' dwelling:	
New lot.....	500
Three-family house, tile and concrete, 45 by 40 by 30 feet, 54,000 cubic feet, at 30 cents per cubic foot.....	19,500
Outbuildings.....	1,000
Sidewalks, grading, fences, shore protection, etc.....	1,500
Grand total.....	75,000

No. 21. *Tampa Bay, Fla., aids to navigation.*—Establishing and improving aids to navigation in Tampa Bay, Fla., \$17,500.

NOTE.—The act of June 5, 1920 (Pub. No. 275, 66th Cong.), authorized this work, but no appropriation was made therefor. Tampa is an important seaport with a large and growing commerce by sea. Owing to shallow water in Tampa Bay, deep-draft vessels can reach the city from the Gulf only by means of several comparatively narrow dredged cuts. Provision has already been made for lighting all of the important cuts excepting cut D, for which lights should be provided as soon as practicable, as large vessels must pass through this cut in order to reach Port Tampa. Detailed estimate:

Tower, structural steel, at 19 cents per pound (32,100 pounds), and cast iron, at 8.8 cents per pound (41,860 pounds).....	\$9,800
Reinforced-concrete piling, in place, at \$15.20 per cubic foot (125 cubic feet).....	1,900
Illuminating apparatus (including installation).....	5,800
Total.....	17,500

22. *Depot keepers' dwellings, Goat Island, Calif.*—Construction of two dwellings, at the Goat Island Lighthouse Depot, Calif., \$16,500.

NOTE.—The act of June 5, 1920 (41 Stat., 1059), authorized this work, but no appropriation was made therefor. The present quarters at the Goat Island Lighthouse Depot, consisting of two old frame cottages located at the water's edge, are wholly inadequate to accommodate the depot force. There are no quarters available for the assistant depot keeper, mechanic, and skilled laborer, all of whom are required to make long journeys to and from San Francisco each day. On account of the position of Goat Island in the middle of San Francisco Bay, with no ferry accommodations except such as can be obtained by means of the naval training station boats, it is essential that all employees at the depot should be housed on the lighthouse reservation, as they are unable to properly carry on their work under present conditions. Orders have recently been issued by the Navy Department to remove the naval training station from Goat Island on account of inclement weather conditions, and it is probable that the present launch service to the island will be very seriously reduced in the near future with great detriment to the Lighthouse Service. Two dwellings are urgently required to be built on the high ground adjacent to the depot for the accommodation of the keeper and the mechanic in charge of the depot shops. Detailed estimate:

Two dwellings for keepers, at \$0.252 per cubic foot (65,455 cubic feet).....	\$16,500
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No. 23. *Depot for second lighthouse district.*—Completing the construction and equipment of a lighthouse depot for the second lighthouse district, \$85,500.

NOTE.—The act of July 1, 1918 (40 Stat., 607), appropriating \$85,000 for dredging two slips, building retaining walls to same, rebuilding wharf, building service building and oil house, etc., at Chelsea, Mass., was based upon estimates made in 1911. The great advance in cost of building materials and labor since the original estimate for this project was submitted, notwithstanding some recent reductions, makes the appropriation inadequate for the purpose intended. The lighthouse depot in the northern end of the second district, which was located on Lovells Island about 9 miles from Boston, on land belonging to the War Department and urgently required by them for war purposes, greatly handicapped the work of the district and increased the duties of the tenders by having the base of supplies located nearly an hour's steaming from Boston. The new depot at Chelsea should be properly equipped at the earliest practicable date. Detailed estimate:

Dredging two slips and in front, 21,000 yards, at \$0.80.....	\$16,800
Retaining wall repairs, 500 yards, at \$10.....	5,000
Capping retaining walls, 200 yards, at \$20.....	4,000
Wharf, 6,896 square feet, at \$2.50.....	17,240
Filling and grading, 500 yards, at \$4.....	2,000
Carpenter shop and storehouse, 30 by 60 feet, 9,600 cubic feet, at \$0.75.....	7,200
Buoy cleaning shed, 20 by 50 feet, 8,000 cubic feet, at \$0.40.....	3,200
Chain platform, 2,000 square feet, at \$2.....	4,000
Sinker platform, 1,500 square feet, at \$2.....	3,000
Boundary fence, 270 linear feet, at \$8.....	2,160
Railroad, 1,800 feet, at \$3.....	5,400
Push cars (2), at \$200.....	400
Water main, 3-inch cast-iron, 500 feet in place, at \$5.....	2,500
Machine-shop equipment.....	7,000
Macadam road, 1,200 square yards, at \$2.....	2,400
Concrete walk, 360 square yards, at \$2.50.....	900
Contingencies.....	2,300
Total.....	85,500

No. 24. *San Juan Lighthouse Depot, San Juan, P. R.*—Constructing a new wharf at the San Juan Lighthouse Depot, San Juan, P. R., \$60,000.

NOTE.—The present wharf at the depot is in a dilapidated condition beyond repair. The decking and stringers have rotted to such an extent that the wharf is unsafe for storing buoys and the greater part of the wharf is closed off, so as to prevent men from getting injured by falling through rotten planking. The piles have been destroyed by teredo and, except for temporary fenders, the wharf offers no protection for vessels tied up to it. A new wharf is urgently needed. Detailed estimate:

Wharf, at \$5 per square foot (12,000 square feet).....	\$60,000
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No. 25. *Ketchikan Lighthouse Depot, Alaska.*—Completing the lighthouse depot at Ketchikan, Alaska, in the sixteenth district, \$75,000.

NOTE.—The act of July 1, 1918 (40 Stat., 686), appropriated \$90,000 for a lighthouse depot and the necessary equipment for the sixteenth lighthouse district. This appropriation was supplemented by an item of \$12,000 contained in the deficiency appropriation bill approved March 6, 1920 (41 Stat., 516). All funds appropriated have been expended. A wharf has been completed and a reinforced-concrete storehouse erected. The latter has been provided with a temporary roof and is being used. A permanent roof should be provided, however, and the building should be otherwise completed and fitted for the purpose intended by installation of partitions, fixtures, freight elevator, shelving, etc. Other buildings and equipment

are needed in order to complete the depot and provide suitable facilities for handling stock and carrying on the work of the station with dispatch and in an efficient and economical manner. Separate buildings are needed for carpenter shop, boat shop, and blacksmith shop. The grounds adjacent to the wharf and buildings should be graded and roads and pavements constructed. A dwelling should be erected on the premises for the depot keeper, as the site is on the outskirts of the town where no living quarters are available for rental and the keeper can render greater service if he resides permanently on the grounds.

Detailed estimate:

To complete storehouse.....	\$10,000
Building for carpenter shop and boat shop, concrete, at 12½ cents per cubic foot (160,000 cubic feet).....	20,000
Blacksmith shop, concrete, at 25 cents per cubic foot (20,000 cubic feet).....	5,000
Depot keeper's dwelling, frame, with concrete foundation, at 35 cents per cubic foot (21,000 cubic feet).....	7,500
Minor structures, including gasoline house and garage, at 25 cents (3,500 cubic feet concrete), gravel bin, at 10 cents (8,100 cubic feet, frame), and coal shed, at 5 cents (17,500 cubic feet).....	2,560
Improvements to grounds, grading, and roadways, at \$4 per linear foot (250 feet); concrete pavement, at 30 cents per square foot (6,000 square feet); drains and water-supply piping, at \$2 per linear foot (400 feet).....	3,600
Boat ways, at \$5 per foot.....	2,250
Equipment for storehouse and wharf, including industrial trucks and trailers (\$2,500), air plant and air tools (\$6,200), boathouse hoist (\$6,000).....	14,700
Shop equipment for carpenter shop, blacksmith shop, and machine shop, lot.....	9,330
Total.....	75,000

No. 26. California, aids to navigation.—Establishing aids to navigation, California, \$25,000.

NOTE.—The act of June 5, 1920 (Pub. No. 275, 66th Cong.), authorized this work, but no appropriation was made therefor. Numerous petitions have been received for lighting the channel between Point San Mateo and the mouth of Alviso Slough, San Francisco Bay. This waterway is the natural outlet for nearly all the produce of the extensive Santa Clara Valley, and the annual traffic has been greatly increased on account of the greatly increased demand for this produce. The present channel is narrow and winding and there are no aids to assist mariners in keeping off the shoals at night. Accidents and strandings are of frequent occurrence. Much of the traffic must be carried on at night to take advantage of the tides. Additional lights are urgently needed and should be established at once. Gas buoys should also be provided at Fort Ross and Point Buchon, on the coast of California; these are necessary for the protection of coastwise shipping. There is an urgent demand for a more suitable lighted buoy at Crescent City, Calif.

During the past year one vessel was lost and another damaged at this entrance. There is a heavy traffic in the north channel of Suisun Bay, and two additional lights and echo boards are necessary.

Detailed estimate:

San Francisco Bay, Alviso Channel:	
Acetylene-lighted beacons, 3 at \$1,500 each.....	\$4,500
Acetylene-gas buoy, type L.....	4,000
Coast of California:	
Gas and whistle buoys at Point Buchon and Fort Ross, 2 at \$5,000 each.....	10,000
Gas and bell buoy at Crescent City.....	4,500
Suisun Bay, 2 lights and echo boards, at \$1,000 each.....	2,000
Total.....	25,000

No. 27. Florida coasts, aid to navigation.—Repairing and improving aids to navigation and establishing new aids on the coasts of Florida and in the approaches to Key West, Fla., \$150,000.

NOTE.—The type of structure for beacons marking the Florida Reefs was established many years ago and does not satisfactorily meet existing requirements. These beacons are usually destroyed by every hurricane that passes over them. Twelve of them, every one in its path, were destroyed by the last hurricane (Sept. 9-10, 1919), and the others are in bad condition of repairs as well as structurally weak, and it is expected that they will be destroyed by the first severe storm that strikes the section of reefs where they are located. These are among the most important minor aids to navigation in the world, and assist in marking the Florida Reefs for a distance of 135 miles, along which a large number of vessels with valuable cargoes continually pass. Key West is now one of the largest and most important seaports in the United States. It is Florida's greatest seaport and its exports now amount to over \$85,000,000 per annum and its imports are over \$6,000,000 plus \$22,000,000 in bond—more than twice as great as those of all the other Florida ports combined—and it is increasing steadily. The number of passengers entering and leaving the United States through the port of Key West during the year 1919 was only exceeded by the ports of New York and San Francisco. Key West is an extremely important military and naval base, and a submarine base is now in course of preparation, for which an expenditure of \$2,500,000 has been authorized. There is a large naval station at this port, and it is the headquarters of the seventh naval district. The present system of aids to navigation is inadequate; it does not sufficiently meet the existing requirements of the larger vessels due to increased commerce, as well as those gradually taking the place of the smaller vessels formerly entering this port. At the present time there is a minimum depth of 18 feet at mean low water through Northwest Passage, yet, owing to inadequate aids in this passage and the possibility of grounding with consequent delay, the average master would rather take the longer and more dangerous route around Dry Tortugas than attempt to save 65 miles by taking his vessel through the Northwest Passage when bound from the Straits of Florida into the Gulf of Mexico en route to a Gulf port. It is now proposed to establish a complete system of range lights on permanent structures and gas buoys and other first-class floating aids with adequate moorings, which will not be destroyed or displaced by the disastrous hurricanes that frequently strike this port, but will be in their proper position to enable vessels to enter the harbor at all times and under all conditions to safely guide shipping over the short route from the Straits of Florida on through Northwest Passage and into the Gulf of Mexico and vice versa. The structure at Sand Key Light Station has been in service for 67 years, and many of the castings at the upper end of the tower and under the lantern have deteriorated to their limit of safety and should therefore be immediately renewed. To safely effect a landing at this station, at times, it is necessary that a boat landing be placed on the east side of the key. In order to properly and economically attend to the foregoing aids to navigation it is essential that a small, but good, substantial, seaworthy gasoline motor boat about 35 feet long by 10½ inches beam be constructed for this purpose. Detailed estimate:

12 lights on iron towers: Structural steel, wrought and cast iron, 300,000 pounds, at 20 cents	\$60,000
Wooden tank houses, platforms, and tank hoist (11), at \$175.....	1,925
Painting.....	600
Illuminating apparatus, automatic acetylene-gas lights (6), at \$1,500; 6 oil lens lanterns, at \$175.....	10,050
Spare gas accumulators for recharging (48), at \$125.....	6,000
Acetylene-gas buoys (7), at \$6,000.....	42,000
Metal buoys (4), at \$470; 5 at \$439.....	4,075
Buoy appendages, 149,700 pounds, at \$0.0501.....	7,500
Gasoline motor boat, 30 feet 9½ inches by 4 feet (1), at \$3,000.....	3,000
Sand Key Light Station, repairs to structure, 30,000 pounds ornamental cast iron, at 30 cents.....	9,000
Sand Key Light Station, outside door and window frames, with doors, etc. (25 sets), at \$40.....	1,000
Sand Key Light Station, boat landing on east side of island, 500 square feet, at \$6	3,000
Incidentals.....	1,850
Total.....	150,000

No. 28. *Goat Island Lighthouse Depot, California.*—Extending wharf and making other improvements at the Goat Island Lighthouse Depot, California, \$68,000.

NOTE.—The present wharf at the Goat Island Depot is inadequate for handling the business of the district. This is the only depot in the district, and all supplies and buoyage for the whole district are handled over the wharf. The wharf was built many years ago, when the business of the district was about one-half of what it is at present and when there was only one tender and one light vessel in the district. There are now two tenders and three light vessels in the district, and one-half of the small wharf is constantly occupied by one of the light vessels while relieved for overhauling and repairs. This leaves barely room for one tender to make fast and practically no working room on account of the heavy buoys which it is necessary to keep near the face of the wharf. The work of the district is being conducted at a heavy loss due to delays in handling supplies and loss of time of tenders. Private business would not operate under such a handicap and the district should no longer continue to do so. It is proposed to extend the present wharf for a distance of 150 feet in a southerly direction at a width of 50 feet, to construct a retaining wall in the rear of the new section, and to fill in an area of about 80 feet by 150 feet behind the wall with the material from the adjacent bluffs. It is also proposed to drive two mooring dolphins at the north end of the present wharf to permit dropping the light vessel back from the face of the wharf, and thus increase the working space. The present warehouse for depot supplies is a poorly constructed and overcrowded frame building over 40 years old. It is badly decayed in places and fast getting beyond repair. A plain, reinforced, fireproof building 40 by 100 feet and three stories high is required to replace the present dilapidated two-story structure and furnish necessary storage space. Detailed estimate:

Reinforced-concrete warehouse (40 by 100 feet), 139,000 cubic feet, at \$0.254 per cubic foot.....	\$35,300
Sea wall, 255 linear feet, averaging 12 feet high and 3 feet thick, at \$21.50 per linear foot.....	5,475
Dock fill (approach), 13,125 square feet, at \$0.16 per square foot.....	2,100
Dock extension (50 by 150 feet), 7,500 square feet, at \$3.35 per square foot.....	25,125
Total.....	68,000

No. 29. *Sandusky Bay, Ohio, aids to navigation.*—Constructing a light and fog signal at the entrance to, and improving existing aids to navigation, Sandusky Bay, Ohio, \$108,000.

NOTE.—The act of June 17, 1910 (36 Stat., 536), authorized the establishment of a light and fog signal at the entrance of Sandusky Bay, Ohio, at a cost not to exceed \$80,000, but no appropriation for the project has been made. The need of more efficient aids to mark the entrance to this harbor has been long recognized by marine interests. The entrance is especially difficult to locate in thick weather, and an adequate fog signal is therefore essential. The east jetty is being extended, and a pierhead for the lighthouse foundation at its outer end has been constructed by the United States Engineer Department only to the level of low-water datum. The top of pierhead is therefore about 2 feet below present water level. This necessitates prompt action toward construction of the remainder of the pierhead and station super structure by the Lighthouse Service. Quarters for at least two additional keepers will be required when the new station is completed. Space for same is available on site already owned by the Lighthouse Service in the immediate vicinity. It is also proposed to replace the present frame structures of the inner and outer ranges with steel towers and install an electrical system to operate these lights and the proposed light and fog signal at the end of the jetty. Sandusky is one of the most important ports of Lake Erie, and its lake commerce is extensive. In 1919 the commerce amounted to over 2,000,000 tons, valued at \$16,600,000. There is also a very considerable passenger traffic. Detailed estimate:

Reinforced-concrete base, 1,000 cubic yards, at \$22 per cubic yard.....	\$22,000
Removing old structures and surfacing piers.....	4,880
Steel-tower metal work, 90 tons, at \$250, in place.....	22,500
Power house, 10,000 cubic feet, at \$0.48 per cubic foot.....	4,800
Fog signal and illuminating installation.....	20,430
Submarine cable, 16,900 feet, at \$1.195.....	20,190
Dwelling, 30,000 cubic feet, at \$0.46 per cubic foot.....	13,800
Total.....	108,600

No. 30. *Oswego Harbor, N. Y., aids to navigation.*—Improving aids to navigation and removing old structures at Oswego Harbor, N. Y., \$13,000.

NOTE.—The present fog bell at this station is inadequate. Petitions for a more powerful fog signal have been received from marine interests. It is proposed to carry electric power to the station by means of a submarine cable and install a compressed-air fog signal. There is an old stone lighthouse tower, no longer used, located at the angle in the inner breakwater. The cribwork surrounding this tower is in the custody of the Lighthouse Service and is in a dilapidated and damaged state. The maintenance of this cribwork with lighthouse funds is no longer warranted, although it still forms part of the protection works of the harbor. The War Department has indicated it will take over the care and custody of the lighthouse pier upon removal of the stone structure referred to, and an item for that purpose is included in the estimate. Severe storms are causing additional damage to the cribwork, and it is uncertain as to how soon the foundation of the tower will be endangered. Detailed estimate:

Cable, at \$1.30 per foot (2,200 feet).....	\$2,860
Motor air compressor.....	2,000

Diaphone.....	\$1,200
Piping, valves, and installation.....	1,200
Minor light.....	240
Razing tower and attached structure, 2,000 tons stone, at \$1 per ton.....	2,000
Disposing of material, at \$1.75 per ton, 2,000 tons.....	3,500
Total.....	13,000

Total group No. 1: Authorized by law, \$2,768,000; not authorized, \$1,199,050; total, \$3,967,050.

NOTE.—The difference of \$40,500 between the amount stated above as authorized by law and that stated elsewhere is due to the fact that for three items the estimates as now submitted are less than those previously submitted and actually authorized by Congress.

GROUP NO. 2.

Works considered essential for the needs of navigation and the equipment of the Lighthouse Service, and which it is recommended be undertaken as resources permit, are submitted with estimates of cost. (These items have been selected from a much larger number of recommendations recommended by the superintendents of the lighthouse districts).

FIRST LIGHTHOUSE DISTRICT.

Tumbler Island Light, Maine.—Establishing a light at or near the westerly end of Tumbler Island, entrance to Boothbay Harbor, Me., \$5,800.

NOTE.—The need of a light on Tumbler Island has long been felt and expressed by mariners and others interested. A petition having the names of 196 persons was presented to the Lighthouse Service in 1916. Several vessels have been badly damaged by running on Tumbler Island and one life lost. A light properly located would very much facilitate entering the harbor at night and greatly reduce the hazard.

Otter Island Light, Maine.—Establishing a light on Otter Island, Muscle Ridge Channel, Me., \$3,600.

NOTE.—A light at this point has several times been petitioned for. Muscle Ridge Channel is much frequented by vessels of all classes except those of deep draft, especially by steamers carrying large numbers of passengers. Passenger traffic through the channel is very heavy in summer. Several vessels have been wrecked in Muscle Ridge Channel in recent years, among them the steamer *City of Rockland*, in the summer of 1904. It is proposed to establish an acetylene light.

Ram Island Light, Maine.—Establishing a light on Ram Island, lower Kennebec River, \$6,000.

NOTE.—The need of this light has several times been expressed by petition. Ram Island is about 5½ miles below Bath, Me. It is a low island in the middle of the river, with a string of half-tide ledges making off on the easterly side. There is a passage on either side, and at some stages of the tide a 5-knot current exists, from which several accidents have occurred. According to 1919 statistics about 126,000 tons of freight passed this island in that year, and in addition many pleasure craft and small boats frequent the river. It is proposed to establish an acetylene light on or near the easterly side of Ram Island.

Depot for first lighthouse district.—Purchasing site and constructing and equipping a lighthouse depot in the first lighthouse district, \$180,000.

NOTE.—The present depot at Little Diamond Island is inconveniently located, there being practically no boat service between it and Portland for about half the year. It is expensive to maintain; protection against fire is also a consideration. If a depot could be established on the water front of the city of Portland, the rent of wharf and sheds for tenders, shops for carrying on the repair work of the district, and for office of superintendent would be eliminated. The upkeep of the proposed depot would be less than the cost of the present arrangement by the purchase of a filled wharf, if possible. The sale of the present depot would likely offset considerable of the cost of a new one.

Rockland Lighthouse Depot, Maine.—Constructing and equipping a lighthouse depot, at Rockland, Me., in the first lighthouse district, \$28,600.

NOTE.—The two depots in this district are Little Diamond Island and Bear Island, which are about 100 miles apart. Owing to the many rivers, bays, and estuaries between these places considerable more buoy work is required between the two depots than beyond them. Therefore, if a central place could be established between the two depots where buoys and appendages could be stored, repaired, and painted, the work of the district would be greatly facilitated. The great obstacle to this project has been to find a suitable place having some natural advantages in order to reduce the initial cost and upkeep of such a depot.

SECOND LIGHTHOUSE DISTRICT.

Woods Hole Lighthouse Depot, Massachusetts.—Dredging off a point to give entrance to Little Harbor, Woods Hole Depot, Massachusetts, \$18,000.

NOTE.—The bar through which the channel was dredged in 1917 has again filled in, and it is believed that it is impracticable to maintain a channel through this bar, owing to the excessive current. By cutting off the point referred to and following the natural course of the channel it is believed that no difficulty from filling in will be experienced at this point in the future.

Riprap protection for light stations, second lighthouse district.—Providing riprap to protect foundations of light stations from damage by sea and ice in the second lighthouse district, \$17,250.

NOTE.—Practically all these stations are on submarine sites and are subject to damage from sea and ice. Riprap is needed for the first light mentioned to provide a foundation for an acetylene light. The foundations of the other stations have been considerably damaged and weakened by ice during past winters and should now be protected by riprap to prevent danger of their being more seriously damaged in the future.

Cape Cod Light Station, Massachusetts.—Improving fog signal at Cape Cod Light Station, Massachusetts, \$5,620.

NOTE.—Owing to the elevated location of the fog signal and to its distance from the shore the present signal has been found inadequate in volume to be readily heard by mariners above the sound produced by the heavy surf on the beach at the station. As this is one of the most important fog signals in this district, it is believed that the establishment of a more powerful signal will meet the needs of the mariner. A petition for this change was received from the maritime interests in December, 1919.

Brant Point Light Station, Massachusetts.—Protecting site of Brant Point Light Station, Massachusetts, from erosion, \$5,000.

NOTE.—Owing to the excessive tide at this point the reservation is being rapidly eroded, and it is believed that an apron of small riprap will stop this.

THIRD LIGHTHOUSE DISTRICT.

Great Salt Pond Light Station, Rhode Island.—Completing light and fog signal on extreme end of breakwater, Great Salt Pond, Rhode Island, \$53,000.

NOTE.—An appropriation of \$20,000 for this work was made by the act of June 12, 1917 (40 Stat., 161), but on account of increase in cost of labor and material and of changing the location to extreme end of breakwater, with foundation in much deeper water than was previously planned, and in order to make this harbor available for submarines, the funds previously appropriated are insufficient and an additional appropriation is required to complete the work, the original appropriation being only sufficient to construct the foundation in the extra depth of water.

Staten Island Lighthouse Depot, New York.—Extending and enlarging machine shop at the General Lighthouse Depot, Tompkinsville, Staten Island, N. Y., \$15,000.

NOTE.—The present machine shop is so constructed as to be unadapted for the work which is done in it and will have to be extended and enlarged before it can be made an efficient and economical shop. The act of July 19, 1919 (41 Stat., 213), appropriated \$30,000 for this work, and the act of June 5, 1920 (41 Stat., 1058), authorized \$15,000 additional, but no appropriation has been made therefor. The work can not possibly be done for the \$30,000 appropriated, and \$15,000 additional, or a total of \$45,000, for this work is required.

Staten Island Lighthouse Depot, New York.—Improving and extending the wharves at the General Lighthouse Depot, Tompkinsville, Staten Island, N. Y., \$119,600.

NOTE.—The present south wing of north dock is an iron pile dock with wooden top. The piles and steel girders are good, but wooden top is in very poor condition and unsafe. The bulkhead dock is wood throughout and entire dock is poor. The extension to south dock is necessary for storage space for buoys.

Sag Harbor, N. Y., aids to navigation.—Establishing acetylene lights in the channel leading into and in the vicinity of Sag Harbor, N. Y., and improving Sag Harbor Breakwater Light, and other aids to navigation in that vicinity, \$58,500.

NOTE.—The channel is crooked, narrow, and rocky, and a system of lights to mark turns in channel and so located that vessels can run from light to light is badly needed. The Sag Harbor Light, which marks the entrance of the harbor, is used at long range and is not of sufficient power of light for the purpose. The new lights will be flashing acetylene lights with steel towers, so called, on concrete and riprap foundations.

Lake Champlain, N. Y. and Vt.—Establishing acetylene lights, building and equipping a gasoline tender and rebuilding Juniper Island Light Station wharf to accommodate the tender on Lake Champlain, and other improvements to aids to navigation on Lake Champlain, \$147,000.

NOTE.—In the interest of efficiency and economy it is proposed to discontinue all oil lights on Lake Champlain except at stations where there is a fog bell and establish acetylene lights in their places. The motor-driven tender will remain constantly on the lake to care for the operation and repair of the light stations. This change from oil to acetylene will result in considerable saving. It will permit better care and maintenance of the aids to navigation on Lake Champlain and relieve the tender *Daisy* from this work, thus enabling her to do more work in the vicinity of New York Bay, where her services are much needed.

Coney Island Light Station, New York.—Purchasing necessary land for right of way to the reservation at Coney Island Light Station, New York, \$5,000.

NOTE.—This reservation is located on Sea Girt property at Nortons Point, west end of Coney Island. It was purchased in 1889, at which time there were no other buildings or roads in the vicinity, but since then the surrounding property has developed in such a manner as to give the lighthouse reservation no street front and no other means of egress for the occupants. A right of way is urgently needed to meet a bad situation and can only be obtained by the purchase of property priced at \$5,000.

Riprap protection for light stations, third lighthouse district.—Providing riprap to reinforce light stations and constructing and improving boat landings in the third lighthouse district, \$190,000.

NOTE.—The act of July 19, 1919 (41 Stat., 213), appropriated \$150,000 toward providing riprap for light stations in third district, but this amount was only about one-half of the estimated requirements at that time, and it is now found that to complete this work in an adequate manner an additional appropriation of \$190,000 is required.

FIFTH LIGHTHOUSE DISTRICT.

Inland waterway, Norfolk, Va., to Beaufort Inlet, N. C., aids to navigation.—Establishing and improving aids to navigation to mark the improved inland waterway from Norfolk, Va., to Pamlico Sound, N. C., \$92,000.

NOTE.—The work of the United States Engineers on the 12-foot project for inland waterway from Norfolk, Va., to Beaufort Inlet, N. C., has reached a point where it seems certain that an available depth of 12 feet throughout will be available in the latter part of 1921. Traffic through this waterway is now increasing, and recent reports indicate heavy traffic when the channel is completed. A thorough and adequate system of marking the waterway should be provided.

Cape Henry Light Station, Virginia.—Improving Cape Henry Light Station, Virginia, \$24,300.

NOTE.—This station is the most prominent and frequently visited station in the district, and improvements to grounds and structures should be made, but on account of the cost the service has been unable to complete them from the general maintenance appropriation. The entire reservation requires grading, sewer, and water system. All of the dwellings now on the reservation should be moved to symmetrical positions with respect to tower. It is desirable to change the characteristic of the light at Cape Henry from fixed to flashing, and this can be done most advantageously by operating the light by electricity.

Additional buoys, fifth lighthouse district.—Establishing additional buoys in Chesapeake Bay and York River, Va., for use of Atlantic Fleet, \$44,600.

NOTE.—There were established during the war a considerable number of additional buoys, including many gas buoys, for the use of the Atlantic Fleet in marking approaches to bases and drill grounds in the lower Chesapeake Bay and York River. It was possible to establish and maintain these buoys during the war emergency only by using buoys normally and properly held in reserve for relief purposes, the marking of wrecks, etc., and temporarily discontinuing certain gas buoys in other localities. The reestablishment and maintenance of these aids has been requested by the Navy Department.

SIXTH LIGHTHOUSE DISTRICT.

Additional buoys, sixth lighthouse district.—Establishing additional lighted buoys in various harbors and approaches, sixth lighthouse district, \$60,000.

NOTE.—No other type of aid to navigation is so much in demand by mariners as gas lighted buoys. They are highly efficient aids, but are too expensive to be provided in the requisite numbers from ordinary maintenance appropriations. The sixth district needs more of them. Petitions have been received from maritime interests for several buoys of this type, and it is proposed to establish 12 such buoys and purchase 2 additional for spare use.

SEVENTH LIGHTHOUSE DISTRICT.

Lakes Okechobee and Hicpochee, Fla.—Establishing and improving aids to navigation in Lakes Okechobee and Hicpochee, Fla., including building and equipping a launch to attend such aids and purchasing a site and erecting keepers' dwellings, \$85,000.

NOTE.—There are 140 miles of coast line around Lakes Hicpochee and Okechobee. Along this shore and in the back country adjoining it there are many farms, groves, and cattle ranches, and fishing is a very important and profitable business in these waters. The present aids to navigation are inadequate, both in number and in kind, and it is therefore proposed to establish suitable structures equipped with acetylene apparatus for lights; also structures for day beacons. A site and two dwellings will be needed for the two keepers, and a substantial station boat for attending all aids to navigation.

EIGHTH LIGHTHOUSE DISTRICT.

Sand Island Light Station, Ala.—Constructing keeper's dwelling and appurtenant structures at Sand Island Light Station, Ala., \$12,000.

NOTE.—The act of July 1, 1918 (40 Stat., 686), appropriated \$37,000 for improvements at this station, which does not include the construction of dwelling. It is now estimated that a dwelling and appurtenant structures will cost \$12,000. This provides for a two-story dwelling, comprising living room, dining room, kitchen, bath, and three bedrooms of approximately 170 square feet floor space each room.

NINTH LIGHTHOUSE DISTRICT.

Point Jiguero Light Station, Porto Rico.—Completing the rebuilding of Point Jiguero Light Station, P. R., \$14,500

NOTE.—The act of July 19, 1919 (41 Stat., 213), appropriated \$24,000 for rebuilding Point Jiguero Light Station, which had been destroyed by an earthquake. The work has been undertaken by hired labor, as the most economical method of doing the same, but the amount appropriated has proved insufficient for fully completing the necessary restoration. There is a balance of \$14,507.13 from the appropriation for Point Borinquen, P. R., made by the act of June 12, 1917 (40 Stat., 161), which work has been completed, and this balance, which will enable the station at Point Jiguero to be fully rebuilt, may be utilized without requiring additional appropriation if Congress will make the necessary authorization.

Port Real (or East Point, Vieques Island) Light Station, Porto Rico.—Establishing a light station at or near Port Real, P. R., or East Point, Vieques Island, \$40,000.

NOTE.—The lighthouse at Port Ferro, on the south coast of Vieques, or Crab Island, is one of the primary seacoast lights of the Porto Rican system. The light tower and the keepers' dwelling attached to it are built on top of a rocky promontory undermined for some time by the sea, and the whole structure, already dangerously cracked, is in danger of collapsing. It is urgent to rebuild a lighthouse at or near this point, as this is an important aid to the navigation from St. Thomas to Cuba and other West Indian Islands and the Caribbean Sea. A light in this vicinity is necessary for navigation.

San Juan Lighthouse Depot, Porto Rico.—Constructing an office building at the San Juan Lighthouse Depot, Porto Rico, \$29,700.

NOTE.—The office of the ninth lighthouse district is in a building owned by the War Department. A revocable lease for the use of this building has been granted to the Department of Commerce. The United States Engineer Office of the War Department needs the building for its operations. At any time the lighthouse district may find it necessary to seek other office space, so that it is expedient that the construction of a proper office building located within the depot area belonging to the Lighthouse Service be undertaken at the earliest possible date.

TENTH LIGHTHOUSE DISTRICT.

Fairport Harbor, Ohio, aids to navigation.—Improving the aids to navigation at Fairport Harbor, Ohio, additional to amount appropriated by act of June 12, 1917, \$44,000.

NOTE.—The act of June 12, 1917 (40 Stat., 161), appropriated \$42,000 for improving aids to navigation at Fairport Harbor, Ohio. This estimate contemplated the construction of a new lighthouse on the west breakwater pierhead and installation of a compressed-air fog signal. Owing to the increased cost of all materials and labor the appropriation is insufficient to carry out the project. Upon completion of the new structure an additional keeper will be required, making three in all. Quarters are now provided for only one keeper. An item has, therefore, been included in this estimate to cover remodeling the old dwelling and building a new double dwelling, providing quarters for the three keepers.

Charlotte Light Station, New York.—Improving Charlotte Light Station, N. Y., \$49,500.

NOTE.—This station consists of a low frame tower with fog-signal house addition on outer end of west pier, Charlotte Harbor. The fog-signal house is a frame structure covered with corrugated iron, the floor is concrete, with timber sills resting on concrete piers. The sills are decaying and extensive repairs are urgently necessary. It is proposed to provide a more suitable and permanent structure of steel construction for this station with a higher tower. This will increase the efficiency of the light, as there are numerous lights on shore forming the background. It is also proposed to bring electric power to the station from shore and install an electric air compressor with an improved fog-signal instrument, one of the present oil engine compressors to be retained for emergencies.

Erie Harbor, Pa., aids to navigation.—Improving aids to navigation at Erie Harbor, Pa., and vicinity, \$26,000.

NOTE.—There are three lights and a fog bell on the north pier at Erie Harbor, a steam fog signal located on the beach about $1\frac{1}{2}$ miles north, and a flashing light on the north shore of Presque Isle Peninsula, about $1\frac{1}{2}$ miles west of the steam fog signal. There is no road to the fog signal, and it is very difficult and expensive to supply the station with coal and other supplies. Electric power can be readily brought to the station, and it is proposed thereby to improve the fog-signal plant and extend the power line to Presque Isle Light Station, which will permit a great increase in intensity of the flashlight, and also to utilize the current for other improvements in aids.

Thirty Mile Point, N. Y., aids to navigation.—Establishing and improving aids to navigation at Thirty Mile Point, N. Y., \$32,500.

NOTE.—Thirty Mile Point Light Station is a turning point for vessels bound to or from the Welland Canal, and a fog signal is needed for the guidance of such vessels. The establishment of this aid has been repeatedly recommended by the shipping interests. The dwelling originally intended for one family must be enlarged, or a separate dwelling for one of the families should be provided.

ELEVENTH LIGHTHOUSE DISTRICT.

Marquette Light Station, Michigan.—Improving Marquette Light Station, Mich., \$15,000.

NOTE.—The breakwater at Marquette Light Station originally consisted entirely of a concrete structure and was marked at its outer extremity by an electric light and an electrically operated fog bell. An extension to the breakwater 1,500 feet in length and making an angle with the concrete breakwater has been completed by the United States Engineer Office, the latter structure being of rough stone construction. It is very necessary that the outer end of the breakwater be marked with a suitable fog signal and a more powerful light, which is now proposed.

West Neebish Channel, St. Marys River, Mich., aids to navigation.—Establishing and improving aids to navigation West Neebish Channel, St. Marys River, Mich., \$50,000.

NOTE.—There has long been a demand from vessel interests for range lights in the West Neebish Channel to mark the axis of the upper reaches of this channel. During the past three or four years the ice action in the spring has been so severe as to destroy a number of the permanent structures, making their reconstruction or replacement with floating gas buoys necessary. There are now five of these permanent structures replaced by buoys and two more have been completely rebuilt. The result of replacing so many fixed pier lights with gas buoys has been that there is a considerable period both at the opening and close of the navigation season when ice is running when the buoys have to be removed, leaving the channel

very poorly marked. Range lights would make safe navigation possible under these conditions, as they could be maintained in commission and their construction and maintenance would cost less than to rebuild all pier lights now replaced by buoys.

Michigan Island Light Station, Wisconsin.—Establishing and improving aids to navigation at or near Michigan Island, Lake Superior, Wis., \$85,000.

NOTE.—The act approved May 27, 1908 (35 Stat., 332), appropriated \$2,000 to make a survey and estimate of cost and report upon the feasibility and need of establishing a light and fog signal upon Gull Island, or the easterly end of Michigan Island, Apostle Group. As a result of this survey the conclusion has been reached that the eastern end of Michigan Island is the better site. The act of June 17, 1910 (36 Stat., 533), authorized the construction of a light and fog-signal station at Michigan and Gull Islands at a cost not to exceed \$140,000, but no appropriation has been made therefor. A further study indicates that the best plan is to elevate the present light near the westerly end of Michigan Island, add a fog signal, and establish a nonattended acetylene light on Gull Island. This arrangement would serve as a better guide to vessels passing in either direction. The project now contemplated will not cost as much as the amount authorized.

Portage Lake and River, Mich.—Establishing and improving aids to navigation in Portage Lake and River, Mich., \$75,000.

NOTE.—The fog-signal plant at Portage Lake Ship Canals Light Station will require to be removed at an early date, and it is proposed to replace it with a modern diaphone air signal operated by air compressors and to establish a minor diaphone signal on the extremity of the west breakwater, the latter being electrically operated. This arrangement provides a powerful signal for use of vessels in locating the harbor and a minor signal to actually guide them into the entrance. On account of dredging away of the outer extremities of the two inner piers it is necessary also to make changes in the pier lights. Other needed improvements are contemplated also.

Nine Mile Point Light Station, Michigan.—Establishing a light and fog-signal station at or near Nine Mile Point, Mich., \$50,000.

NOTE.—When Forty Mile Point Light Station was established, it was placed on the site designated Forty Mile Point on the county-survey charts. Sailing masters expected the station to be placed at Nine Mile Point, near the entrance to the Straits of Mackinac, but which was not so called officially then. While Nine Mile Point is within the visibility of Spectacle Reef and Poe Reef light vessel lights, a fog signal would be of especially great service in thick and foggy weather and during seasons when forest fires prevail. No less than nine strandings occurred here between 1903 and 1909. In the event of establishing this station, Forty Mile Point could probably be made a minor light.

TWELFTH LIGHTHOUSE DISTRICT.

Lansing Shoal Light and Fog-Signal Station, Michigan.—Establishing a light and fog-signal station at Lansing Shoal, Mich., \$304,000.

NOTE.—This dangerous shoal, which is now marked by a light vessel, is located at the most important point on the northerly passage to and from the Straits of Mackinac. Maritime interests are urgent in their requests for a better light and a more adequate fog signal, located on a fixed crib. The light vessel is compelled, by reason of ice conditions, to be off her station in the early spring and late fall. The important commerce through this passage, both before the light vessel has been placed on her station and after she is compelled to leave it in late fall, fully warrants that a permanent first-class light and fog signal, rather than a light vessel, be used in this passage. The annual traffic past Lansing Shoal averages not less than 25 to 30 million tons, which, reduced to vessel passages on the basis of an average load of 5,000 tons, which is a fair average for traffic on Lake Michigan and Green Bay, would indicate the annual passage of approximately 5,000 vessels in this vicinity.

Sturgeon Bay, Wis., aids to navigation.—Establishing aids to navigation and improving existing aids at or near Sturgeon Bay, Wis., \$49,000.

NOTE.—The aids now in use for the channel through Sturgeon Bay, especially north (or west) of the bridge, are inadequate, obsolete as to position, and in an advanced state of decay. It is proposed to discontinue the two Dunlap Reef Lights, as they are practically of no use at the present time; also discontinue the Hills Point daymark, Hills Point Gas Buoy No. 3, and Sturgeon Bay Entrance Gas Buoy No. 1. It is proposed to establish one new acetylene light on Hills Point, near site of present daymark, and three new acetylene lights on cribs—one located at northerly end of Dunlap Reef, one on the east side of the channel, about 2,800 feet southeasterly of Hills Point, near site now occupied by Hills Point Spar Buoy No. 5, and one located on the east side of the channel, about 4,500 feet northerly from Hills Point, near site now occupied by Sturgeon Bay Entrance Gas Buoy No. 1.

Grand Haven, Mich., aids to navigation.—Improving aids to navigation at Grand Haven, Mich., \$12,700.

NOTE.—The present air siren fog signal at Grand Haven has been the subject of constant complaint from the vessel interests using this port, which include important car ferry and line boats which enter the port 12 months in the year. It is proposed to replace the present equipment with the latest type of diaphone fog signal and operate same by electric power, which will place the equipment at this station above further criticism; also to place electric light in front lens.

Escanaba Light Station, Michigan.—Improving light and fog signal and constructing and improving dwellings, Escanaba, Mich., \$70,000.

NOTE.—The port of Escanaba (and Gladstone) is one of the most important on Lake Michigan, shipping about 7,000,000 tons of iron ore each season and having coal, grain, and package freight commerce of importance. The light was located on its present site at inner end of Sand Point in 1868. This point is now marked at outer end by Sand Point spar buoy No. 3. The fog bell, operated by hand-power machine, located 1,400 feet from the outer end of the point, is of very little value to the important commerce carried in boats of largest size. It is proposed to make adequate improvements to meet the requirements of present conditions.

Two Rivers, Wis., pierhead.—Improving light and fog signal at Two Rivers, Wis., \$7,400.

NOTE.—This station is now equipped with an electrically-operated fog bell and sixth-order lens illuminated by wick oil light. For several years past there has been an insistent demand from Two Rivers that the fog signal be improved, owing to the fact that craft operating out of Two Rivers found the bell of little assistance in making the port during fog. As it is necessary to maintain two keepers to operate the bell, the operating expense will be increased but little if an adequate and efficient signal is installed.

Manitowoc Breakwater Light Station, Wisconsin.—Construction of dwellings for the keepers at Manitowoc Light Station, Wisconsin, including authority for disposition of certain of the present lighthouse property in Manitowoc, Wis., \$20,050.

NOTE.—The present dwelling used by two of the three keepers is badly located, as the view of the harbor is now entirely cut off by the present surrounding buildings. The dwelling is on the lot where stood the original Manitowoc lighthouse tower, located in 1840, which was razed in 1895. In order to facilitate the work of the station and make the service more efficient, purchase of a new lot is under way. This lot is located close to shore of lake on high ground at the inner end of the north breakwater. From dwellings located on this new lot the keepers will be able to overlook the aids in the harbor and give more efficient and economical service in their operation.

Milwaukee Lighthouse Depot, Wisconsin.—Improving the lighthouse depot at Milwaukee, Wis., \$7,500.

NOTE.—The present room for storage is crowded and inadequate and considerable material must now be left exposed to weather for lack of adequate shed room. It is proposed to construct a shed about 24 by 144 feet, one story high, of semireproof type, which will make depot reasonably adequate until such time as it may be practicable for Congress to grant funds for a new depot at a new and cleaner site.

SIXTEENTH LIGHTHOUSE DISTRICT.

Yukon River, Alaska, aids to navigation.—Establishing aids to navigation on the Yukon River and tributaries, Alaska, and for purchase of equipment for installation and maintenance, \$110,000.

NOTE.—Requests have been received from transportation companies operating on the Yukon, Tanana, and Iditarod Rivers, Alaska, and by other persons interested, for the establishment and maintenance of suitable beacons and lights to mark important points and river crossings in the navigable parts of these rivers. The act of June 5, 1920 (41 Stat., 1059), authorized the establishment and maintenance of aids to navigation on the Yukon River and tributaries from the general appropriation of the Lighthouse Service, but funds are not available for purchase of the necessary materials and apparatus for installing such aids and for the purchase of necessary floating and other equipment for tending the aids.

SEVENTEENTH LIGHTHOUSE DISTRICT.

Grays Harbor Light Station, Washington.—Improving Grays Harbor Light Station, Washington, \$20,000.

NOTE.—The present steam fog-signal plant at this station is located in a frame building. Both the machinery and building are quite old and in poor condition. It is proposed to construct a new fireproof building and install a more modern fog signal as soon as funds permit.

Ediz Hook Light Station.—Improvements at Ediz Hook Light Station, Washington, \$12,000.

NOTE.—The storm of November 26, 1920, carried away the wharf, boathouse, and approach belonging to the subdepot at this station. The work of the service has been greatly handicapped by the loss of this wharf, which formed a landing place for buoys and appendages and for light vessel moorings.

Washington and Oregon, aids to navigation.—Establishing and improving aids to navigation in the States of Washington and Oregon, \$50,000.

NOTE.—The urgent demand for more and better aids has exhausted the special appropriation heretofore made, and current appropriations for the operation of the district are insufficient to provide for new buoys and minor aids urgently demanded throughout the district.

Bush Point Light Station, Washington.—Establishing a light and fog-signal station at or near Bush Point, Puget Sound, Wash., \$46,000.

NOTE.—This is a low point, and the currents in the vicinity are strong and irregular. Several serious collisions have occurred between Bush Point and Point No Point through inbound and outbound vessels following the shore of Marrowstone Island during foggy weather on account of the echo which can be obtained from it. This aid was petitioned for by the Shipmasters' Association of America during September, 1918, and was considered by that association as the second most important aid required for Puget Sound.

Alki Point Light Station, Washington.—Improvements at Alki Point Light Station, Washington, \$3,000.

NOTE.—No provision has heretofore been made for a workshop and storehouse at this station, and the need of one is urgent. It is proposed to erect a fireproof building, the work to be done by contract, this being considered the most economical and advantageous method.

EIGHTEENTH LIGHTHOUSE DISTRICT.

Ballast Point Lighthouse Depot, California.—Construction of wharf for buoy and lighthouse depot at Ballast Point Light Station, California, \$6,100.

NOTE.—There is no buoy depot in the eighteenth lighthouse district south of San Francisco and no site for one on lighthouse property except at San Diego. San Diego is 450 miles distant from San Francisco, and at present it is necessary to carry all buoys for this stretch of shore line back and forth from San Francisco. This results in a great expense and loss of time in relieving buoys, and an auxiliary buoy depot is needed to serve as a working base for the buoyage in the southern part of the district. Additional land has recently been acquired from the War Department on which to construct the proposed wharf.

Red Rock Light and Fog Signal, California.—Establishing a light and fog signal on Red Rock in the northern part of San Francisco Bay, Calif., \$14,350.

NOTE.—Red Rock is a bold, rocky island in the northern part of San Francisco Bay, rising to a height of 150 feet, with deep water close to its shores. It lies in the path of the very heavy up-bay and up-river traffic, as well as in the path of all craft proceeding to and from the Mare Island Navy Yard, and is also directly in the path of the passenger and automobile ferry steamers plying between Castro Point and Point San Quentin. Requests have been received from the masters of river steamers, of oil tankers, and others to suitably mark this island with a fog signal and light. It is proposed to establish a compressed-air diaphone on the south end of the island and to establish a sixth-order flashing electric light of about 3,200 candlepower.

Point Pinos Light Station, California.—Improving Point Pinos Light Station, California, \$16,500.

NOTE.—The harbor of Monterey is a regular port of call for coasting steamers operating between San Francisco and Los Angeles. It is also the shipping port for large quantities of crude oil, and some of the largest oil carriers on the coast enter this port regularly. The harbor is also the headquarters of upward of 2,000 large fishing boats. Heavy fogs are frequent at this part of the coast, and at present there is no protection for vessels entering the harbor. Numerous applications have been received from shipowners and shipmasters for the establishment of a fog signal at the light station, and there is a very urgent need for its establishment as soon as practicable. The combined dwelling and tower at this station was built in 1855 and is only sufficient to house the present keeper. An additional dwelling is needed.

Santa Barbara Light Station, California.—Improving Santa Barbara Light Station, California, \$20,000.

NOTE.—A combined dwelling and tower at this station was built in 1856 and is entirely too small to accommodate the modern revolving lens now installed in it. The tower stands one-eighth of a mile back from the shore line, and the light is at present obscured by trees on adjacent properties. A new tower should be built farther out near the shore line and a first-class compressed-air fog signal installed, with quarters for the additional keeper that will be required. Northbound coasting vessels keep close in shore to avoid the prevailing northwesterly wind and sea, and a fog signal at this point is required. The nearest aid to navigation to the southward is Point Hueneme Light Station, 30 miles distant, while the nearest aid to the northward is the Point Conception Light Station, nearly 40 miles distant. There is heavy traffic through the Santa Barbara Channel at all times, and the distance of 70 miles between adjacent fog signals is too great for the proper protection of navigation.

Piedras Blancas Light Station, California.—Improvements at Piedras Blancas Light Station, California, \$5,400.

NOTE.—This is a large station, with a first-class fog signal and a first-order light. The keeper occupies a separate dwelling, which was constructed when the fog signal was established, and the three assistant keepers occupy one two-story dwelling, which was intended for the accommodation of but two keepers. The quarters are dark and very poorly arranged, and the third assistant keeper has but three small rooms widely separated, one being on the lower floor and two on the upper floor. It is necessary in order to maintain decent living conditions to assign the whole building for the use of two keepers as was originally intended. Great trouble has been experienced in keeping assistants on this station on account of the congested condition and the trouble which constantly arises between assistant keepers' families. A new set of quarters for the first assistant keeper is urgently required.

NINETEENTH LIGHTHOUSE DISTRICT.

Cape Kumukahi Light, Hawaii.—Establishing a light at or near Cape Kumukahi, Hawaii, \$18,500.

NOTE.—Cape Kumukahi is the easternmost cape of Hawaii. It is a difficult point to round when sailing from Hilo to the south point, or vice versa. A light on this point would be a great improvement in the lighting of the islands. An acetylene light is recommended, with a focal-plane height of about 120 feet above the sea, which would be visible about 12 to 15 miles. Landing from seaward at the cape is impossible at most times, and the only practical method of supplying this station would be by railroad from Hilo to Kapoho and then by wagon road 3 miles to the cape, 1½ miles of which would have to be constructed over the rock.

Kauhola Point Light Station, Hawaii.—Improving the light station at Kauhola Point, Hawaii, \$22,000.

NOTE.—A fourth-order flash lens with i. o. v. apparatus is now installed on a temporary frame tower at this station. This is an important landfall station, and it is recommended that the light be raised to a focal plane height of 110 feet. To support this lantern and lens and complete the improvements at the station, a 72-foot reinforced concrete tower with spiral cast-iron stairway and standard fourth-order round lantern is recommended. A dwelling for the assistant keeper is very urgent.

Total Group No. 2 (not included in estimate), \$2,489,870.

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ANNUAL REPORT
OF THE
COMMISSIONER OF LIGHTHOUSES
TO THE
SECRETARY OF COMMERCE
FOR THE
FISCAL YEAR ENDED JUNE 30, 1922



WASHINGTON
GOVERNMENT PRINTING OFFICE
1922

C. W.

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REPORT OF THE COMMISSIONER OF LIGHTHOUSES.

DEPARTMENT OF COMMERCE,
BUREAU OF LIGHTHOUSES,
Washington, September 15, 1922.

SIR: The following report is submitted of the operations of the Lighthouse Service for the fiscal year ended June 30, 1922:

MORE IMPORTANT ACTIVITIES OF THE LIGHTHOUSE SERVICE DURING THE YEAR.

In addition to the three initial radio fog-signal stations established last year on Ambrose Channel and Fire Island Light Vessels and at Sea Girt Light Station, in the vicinity of New York Harbor, radio fog-signal stations were placed in commission during this year on San Francisco Light Vessel, California, and on a relief light vessel in the third district. Radio fog-signal apparatus was also installed on light vessel 105, which was completed during the fiscal year, and was placed on station August 31 on Diamond Shoals off Cape Hatteras, N. C. Materials have been ordered for radio fog-signal installations on two light vessels stationed in Massachusetts waters, two in Pacific coast waters, one off Cape Charles, Va., and at Cape Henry Light Station, seacoast of Virginia. A detailed description of radio fog signals and their use in connection with the radio compass was given in the annual report of the Commissioner of Lighthouses for the fiscal year 1921, pages 24 to 30.

Hereafter the Lighthouse Service will maintain regular radio communication with 20 light-vessel stations, including all the principal outside vessels; this will be of great advantage in reporting cases of distress at sea and in the operation of the light vessels. A plan was agreed upon with the Navy Department for taking over the radio equipment and for relief of the Navy men detailed for duty on some of these vessels.

Three new lighthouse tenders were completed and placed in commission during the year. New light vessel No. 105 was completed and was put in commission August 31 on the important station, Diamond Shoals, N. C. Five new light vessels are being constructed, their status ranging from about 23 to 45 per cent completed at the end of the fiscal year. These vessels are being built under an appropriation of \$1,000,000 made by act of March 4, 1921, this being part of the \$5,000,000 vessel-rebuilding program which was authorized by act of June 5, 1920, but for which no further appropriation has been made.

During the year important improvements were completed or in progress at lighthouse depots at Chelsea, Mass.; Staten Island (General

Depot), N. Y.; Galveston, Tex.; and Detroit, Mich.; to aids to navigation on the Hudson, Delaware, St. Johns, Mississippi, Detroit, and St. Marys Rivers; to aids on Chesapeake Bay, Florida Reefs, Fairport and Conneaut Harbors, Ohio; Indiana Harbor, Ind.; and Guantanamo Bay, Cuba; at Point Jiguero Light Station, P. R.; Dry Tortugas Light Station, Fla.; Galveston Jetty Light Station, Tex.; Poverty Island Light Station, Mich.; Spectacle Reef Light Station, Mich.; and South Pass Range Rear Light Station, La.; and rebuilding and repairing aids to navigation damaged by successive storms on the Atlantic and Gulf coasts. There were 49 aids to navigation established in Alaska during the year, of which 9 were lights and 3 gas buoys. The total number of aids to navigation in Alaska is now 584.

SUMMARY OF MORE URGENT NEEDS OF THE LIGHTHOUSE SERVICE.

1. There is urgent need of legislation permitting the readjustment of pay of the technical and supervisory and clerical staff of the Lighthouse Service. These are now distinctly and greatly underpaid, considering the extent and responsibility of the work, the technical requirements, the cost of living, and the purchasing value of the dollar, and the rates of compensation now in effect in comparable services both within and without the Government, and in other parts of this service itself.

2. Provision is urgently needed for replacing a number of vessels of the Lighthouse Service which have been worn out in service or which will soon have to be condemned. The vessels now under construction, or being reconditioned, will meet only a portion of the immediate requirements. It is not safe or economical to continue the use of vessels no longer fit for service.

3. Provision is greatly needed for improved depot facilities in several districts, for a lighthouse at Cape Spencer, Alaska, for radio fog signals, and for improvements to important aids to navigation as listed in the estimates for special works, selected as most urgent from a long list of meritorious items.

4. Legislation is greatly needed extending the retirement system in the Lighthouse Service to cases of disability incident to the work other than injuries received in the line of duty, already provided for.

5. Legislation is important to better define the relations of the Lighthouse Service to the Navy under the act of August 29, 1916, providing for its transfer in time of national emergency.

More complete explanations of these and other recommendations are given later in this report.

SPECIAL LEGISLATION NEEDED.

INCREASE OF STATUTORY SALARIES.

The legislation most urgently needed for the Lighthouse Service at the present time is a revision of the salaries now fixed by statute and which have not been adjusted to meet changed conditions since the reorganization of this service in 1910, so as to permit the service to again attract, as it formerly did, a high grade of suitable and efficient employees. In highly technical work such as that of the Lighthouse Service there is great waste through loss of time and ineffective work, when, as has become more and more the case in the last few years, the

service does not offer sufficient compensation to attract to it a personnel suited to its special needs, nor to retain many who do enter it. The proportion of trained and efficient personnel has diminished to a serious extent during recent years.

There are at the present time very great and unjust inequalities in the scales of compensation of branches of the Government having duties of similar responsibility and requiring similar qualifications, and certain portions of the personnel of the Lighthouse Service particularly suffer in this respect. This applies especially to statutory salaries in district offices and the bureau at Washington. The fact that Congress has both directly and indirectly, through lump-sum appropriations, provided in recent years much more liberal pay schedules for new organizations and has made substantial increases in pay for the military services and has extended these to several services with civil duties, but subject to transfer to the Navy in time of war, as is the Lighthouse Service under the laws enacted, has greatly increased the difficulty of operating the Lighthouse Service with its inadequate and unadjusted salary scales. At present officers in the Lighthouse Service charged with important responsibilities are in some cases receiving less than half the compensation of persons in other services in similar status and with no greater responsibilities or requirements.

The Lighthouse Service is one of the largest and most extended technical organizations of the Government, and a great variety of duty and extent of responsibility are required of its staff. They are subject to duty in the most expensive cities, as well as in remote outlying possessions, and they are responsible for the efficient maintenance of a plant of great value and importance. The service is operated with a minimum of overhead technical and office staff, and the amount required to bring about some reasonable readjustment of compensation would be a very small proportion of the expenditures for this work or even of the amounts by which the service has reduced its operating expenses.

PROVISIONS FOR RETIREMENT FOR DISABILITY AND OTHER CHANGES IN LIGHTHOUSE SERVICE RETIREMENT LAW.

For the persons in the Lighthouse Service covered by the act of June 20, 1918, it is very desirable that the retirement provisions be extended to cover cases, not due to vicious habits or misconduct, where an employee is found to be disabled for useful service before reaching the age fixed in the act. Because of the responsible and arduous character of much of the work, especially on vessels and at light stations, such provisions will add materially to the efficiency of the service, and relieve cases of serious hardship now arising. There is provision for retirement of persons incapacitated for duty in the Coast Guard and in the Army and Navy. In the general civil service retirement law of May 22, 1920, there is provision for retirement, after '15 years' service, for disease or injury not due to vicious habits. Persons coming under the lighthouse retirement act of June 20, 1918, are the only ones in the military or civil service of the Government to whom some such provision does not now apply, and legislation is needed to remedy this. Some other modifications in the retirement law are desirable in the interest of efficient organization.

EXTENSION OF MEDICAL RELIEF FOR LIGHT KEEPERS.

Light keepers are now entitled to medical relief at hospitals and stations of the Public Health Service. These hospitals are, however, inaccessible for a large number of light keepers who are stationed at remote or isolated points. Equal benefits should be extended to all light keepers, and legislation is needed to provide medical relief for all, and this has been concurred in by the Public Health Service and the Secretary of the Treasury.

OTHER MEASURES FOR RELIEF OF PERSONNEL.

Legislation is needed to permit the adjustment, within a moderate amount, of claims by lighthouse employees for loss or damage to personal property, such as clothing, furniture, etc., caused by storms, collisions, or fire at light stations, depots, and on vessels. Legislation is also needed to give corresponding employees of the Lighthouse Service certain necessary privileges now accorded by law to similar services, including the purchase of commissary supplies, transportation of families and of household effects when ordered to change station permanently, and transportation on Army transports.

PROTECTION OF AIDS TO NAVIGATION.

Legislation is needed for the better protection of aids to navigation. Such aids, especially those located in the water, are often damaged by passing vessels, and it is difficult in many instances to locate the party at fault. More stringent requirements are necessary as to failure to report such injuries, etc. Sums received in payment should also be made available for repair of aids.

ECONOMIES IN THE OPERATION OF THE LIGHTHOUSE SERVICE AND REDUCTION OF APPROPRIATIONS.

The safety of shipping and protection of lives depend on the reliability and efficiency of the lights, fog signals, buoys, and other aids to navigation. It is necessary to maintain high standards in this work, and any saving of expense by going below reasonable standards as to equipment, structures, or personnel would not be true economy. An aid to navigation that can not be depended upon may be worse than none.

Nevertheless, without lowering of standards, and in fact with a steady improvement of plant and service, material economies have in recent years been effected in the operation of the Lighthouse Service. Some of these are briefly mentioned as follows:

REDUCTION OF TOTAL MAINTENANCE APPROPRIATIONS.

There has been a reduction of \$561,000 per annum (about 7 per cent) in the appropriations for maintenance of the Lighthouse Service from the peak of war-time costs in 1921 to the present fiscal year. The appropriations for maintenance for 1923 are still about 45 per cent higher than for 1918, but this increase is less than that for comparable services, and covers not only the continued higher costs of supplies and services but an increase of 699 in the number of aids maintained. A portion of this increase in mainte-

nance can not be removed, as it represents reasonable increases in service compensation of classes of employees, as light keepers and vessel men, heretofore seriously underpaid. Furthermore, there are parts of the personnel of the service still much underpaid, and a large amount of improvement and upkeep work, deferred during the war, must also now be cared for.

Under the act of June 17, 1910, reorganizing the Lighthouse Service, reduction of \$433,700 was made in the maintenance appropriations for 1912, as compared with 1911, and for seven years thereafter the Lighthouse Service was maintained on annual appropriations less than those for 1911, notwithstanding a large steady increase in the number of aids to navigation maintained. Savings due to the reorganization were effected by the discontinuance of 11 local offices and 5 tenders of the service, and a reduction of 200 in the number of employees, and otherwise, and construction was deferred on 3 other tenders.

SAVING IN IMPROVED APPARATUS AND CONSTRUCTION.

Large economies in operation have been effected by the use of automatic lighting and fog-signal apparatus, obviating the need of keepers at certain stations. In the past 12 years 95 stations have been changed from attended to automatic, at a saving of approximately \$100,000 a year. Notwithstanding a considerable increase during this time in the number of lights maintained, the number of light keepers has actually diminished from 1,530 to 1,445. The service now maintains 747 automatic lights on fixed structures and 638 buoys having automatic gaslights; these are all aids of the greatest value to shipping, maintained at moderate expense in comparison with their usefulness. This recent development of the use of lights not requiring keepers represents a large economy in meeting the needs of shipping.

Buoys equipped with automatic fog signals as well as lights are being constructed to replace two inside lightships, and this change will save \$30,000 annually. One buoy replacing a small light vessel and two fixed stations have been similarly equipped at a total annual saving of \$5,000.

A large future economy is being effected through the construction of more permanent structures at light stations, depots, etc., as resources permit. This is also a measure of efficiency, greatly increasing the reliability of the aids. An example is the recent rebuilding of 14 post-light foundations in the Hudson River. The former wooden cribs, which were repeatedly destroyed by ice, have been replaced by concrete foundations, not only saving about \$3,800 in annual repairs, but permitting the lights to be in operation before the ice goes out.

Much of the special apparatus of the Lighthouse Service is now being made at the General Lighthouse Depot, Staten Island, N. Y., at a material saving as compared with former contract prices.

ECONOMY IN ILLUMINATING APPARATUS AND PURCHASE OF ILLUMINANTS.

There has been a great increase of efficiency in the use of kerosene oil as an illuminant through the installation in recent years at all the principal lighthouses of incandescent oil-vapor lamps in place

of the wick lamps formerly used. The number of oil vapor lamps in use has increased from 80 in 1910 to 317 in 1922. With this lamp, in which the kerosene is vaporized and burned under a mantle, there is an increase of 8 to 10 times in the illuminating power obtained in burning kerosene; and for the principal lights there is also a considerable saving in the consumption of kerosene. For example, at Cape Hatteras the oil consumption was reduced from 2,300 to 1,000 gallons per annum, with an increase of candlepower from 27,000 to 80,000. For the smaller order lights there is no saving in kerosene, but a greater percentage of increase in candlepower. With this lamp the cost of kerosene for 1 candlepower for one year has been reduced from 80 cents to 10 cents for the lamps without lenses.

A large saving has been effected in the purchase and distribution of kerosene for the Lighthouse Service through the installation of storage tanks and the delivery of oil in bulk. Installations of tanks and arrangements to this end have been in progress for several years, and the coming year practically all of the kerosene will be purchased in bulk or handled in large containers, so far as it is practicable to so deliver it at the light stations; the saving in so doing is, at present prices, about \$50,000 per annum. Continual test is made of other illuminants and methods; for minor lights, where commercial current is available, electricity is used, effecting a saving especially in attendance; there are now 181 lights using electric incandescent lamps. On the other hand, a primary lighthouse equipped with an electric power plant was changed to incandescent oil vapor, at a saving of \$11,000 annually, with satisfactory results.

Because of the great increase in the cost of cut-glass lenses, pressed lenses have been adopted for gas buoys, at a considerable saving; and the introduction of rapidly revolving mechanism has permitted the use, at principal stations, of much smaller lenses, giving greater concentration of the light in a smaller number of beams, effecting a large saving in equipping new lighthouses.

DISCONTINUING OF AIDS TO NAVIGATION.

Although the changing needs of shipping, with the use of deeper draft vessels and the demands in new regions such as Alaska, have caused a steady net increase in the total number of aids to navigation maintained, a large number are discontinued each year as no longer necessary. A special examination made in 1921 resulted in the discontinuance of 199 aids, and these, with the changing of attended to automatic lights, and a readjustment of the complements of keepers at stations, effected a saving of \$36,000 in annual maintenance and of \$43,400 in the value of property available for other uses. In the ordinary work of the service from 500 to 600 aids to navigation are discontinued annually.

REDUCTION OF COSTS OF VESSELS.

The Lighthouse Service has at present 117 vessels in commission, of two classes, tenders and light vessels, and their cost of maintenance is nearly one-half of the total operating cost of the service. The total number has remained substantially the same since 1910, notwithstanding the considerable increase in the work. Since 1910 the number of light-vessel stations has been reduced from 54 to 49, several having been replaced by fixed aids or buoys, with an approx-

imate saving of \$25,000 per annum. In the same interval there has been a small increase in the number of tenders, because of the increase of 4,660 in the total number of aids to navigation, including 413 gas buoys and 649 automatic lights. The number of aids maintained per tender has increased from 230 to 292, and the number of gas buoys and automatic lights per tender has increased from 6 in 1910 to 25 in 1922. The use of tenders has been economized in many ways, especially by coordination of all the work in each district, and by their equipment with radio, better controlling their movements, often saving long trips.

A case in point occurred recently on the coast of Maine, when the keeper of a light station reported to the district office by telephone that a large can buoy had broken adrift from its moorings and was moving away. Orders were sent by wireless to a tender that was working buoys a few miles away, with the result that the buoy was recovered and replaced on its station before sunset, thus safeguarding shipping by promptly replacing the buoy on station, besides saving the buoy and probably a day's steaming by the tender.

Since war-time conditions there has been a net reduction of \$400,000 in the operating costs of vessels, through revision of pay schedules and subsistence allowances, while at the same time a beneficial system of longevity increase of pay has been introduced for all persons on vessels, and provision has been made for operators to maintain regular radio communication on 26 light vessels.

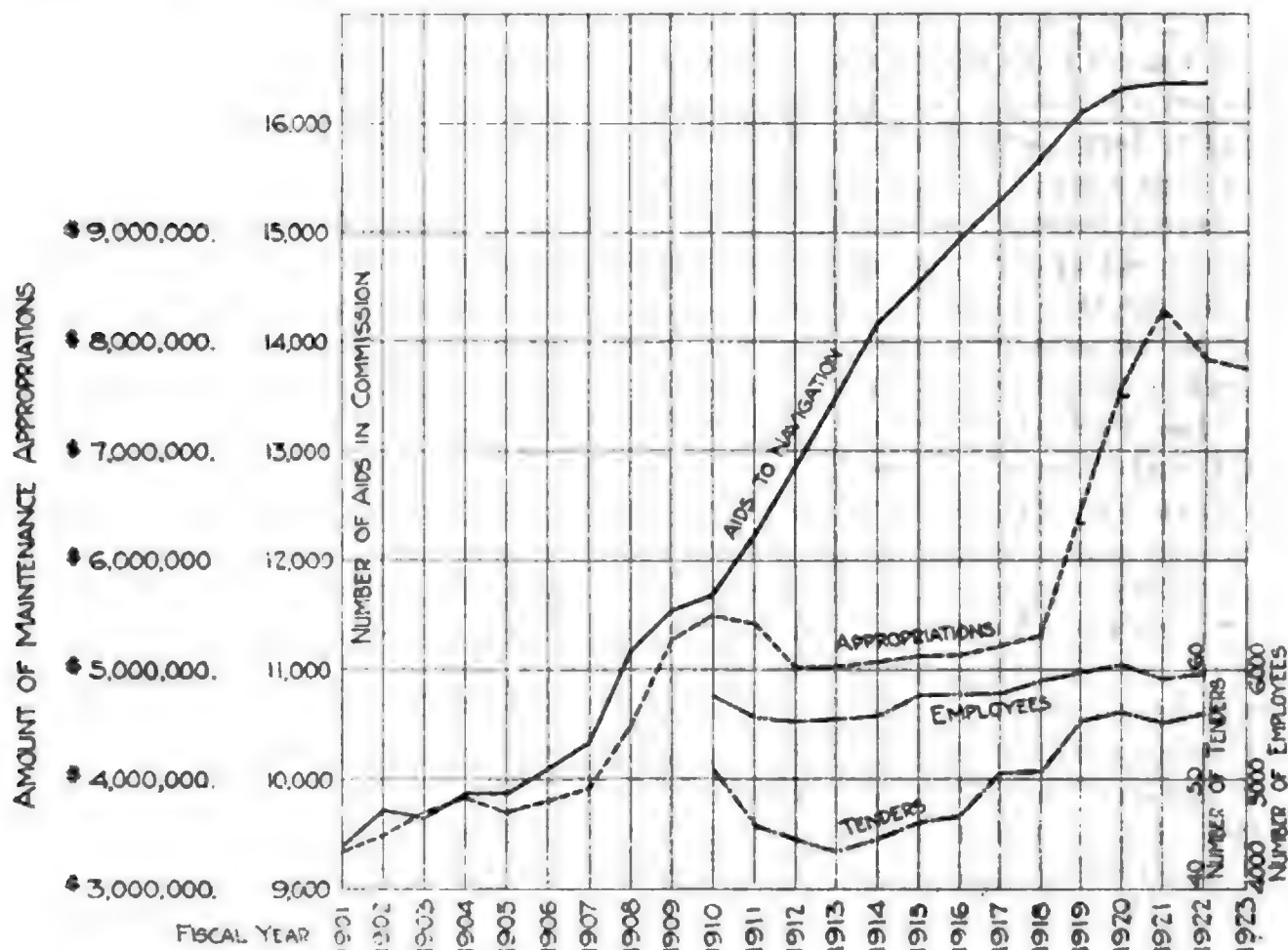
Since the close of the war extensive use has been made of equipment available from other departments, at a large saving. Nine vessels used as mine layers by the War Department have been transferred to the Lighthouse Service and are being converted into tenders as needed; it is estimated that the resulting saving in the cost of construction of new vessels for this service will ultimately be \$1,500,000. Equipment of boilers, boats, etc., transferred from the Navy Department and the Shipping Board will result in a saving to this service estimated at \$150,000.

PERSONNEL.

The ultimate economy of a work depends more on the efficiency of personnel than on any other factor. Economy will not be attained by any course which lowers the standard of personnel or reduces it in numbers below the actual needs. This service for years has been maintained with practically the same number of employees, the total in 1910 being 5,750 and in 1922, 5,985, an increase of only 4 per cent, while the number of aids to navigation has increased 40 per cent during the same period. The number of aids maintained per employee has increased in this period from 2.0 to 2.7, or 35 per cent. The total number of persons at the headquarters of the service in Washington has diminished from 53 in 1910 to 40 in 1922; the latter is two-thirds of 1 per cent of the total force, probably a less proportion in Washington than that in any other service of the Government. The vessels of the service are maintained with complements of the smallest number necessary to accomplish the work, the total number of officers and men on the largest seagoing lighthouse tenders being only 32 to 34.

The well-being, and consequently the efficiency, of the personnel of the Lighthouse Service has been greatly improved in recent years

by various measures, particularly the special retirement law for the field force, the general retirement law, and increases of pay granted light keepers, vessel men, and shop men. Although these measures involve some expense, they represent a true economy in improved efficiency and morale. Unfortunate legal restrictions have prevented practically any proper adjustment being made of the pay of the civil engineers and other technical men, supervisory officers, and clerical forces. It would require an increase in the appropriation of only



U. S. Lighthouse Service. Diagram showing number of aids to navigation maintained, and amount of appropriations for maintenance, yearly from 1901, and employees and vessels from 1910. The number of aids to navigation increased from 1910 to 1922 by 4,711, or 40 per cent.

about 1 per cent to extend the readjustment to these, and the failure to do this is not economy, as it will undoubtedly cost much more than the amount required, by reason of loss of trained personnel and decreased effectiveness.

ECONOMY IN PUBLICATIONS.

The expense of printing the publications of the Lighthouse Service, average of the last three years, is about \$14,500 per annum, a reduction of \$5,000, or 27 per cent from the cost 10 years before, notwithstanding the large increase in the unit costs for printing and paper during this interval, and the large increase of 40 per cent in the number of aids to navigation included in these publications. This economy has been brought about directly by the rearrangement and simplification of the light and buoy lists and the annual report. There has been no loss in usefulness of the publications, but on the contrary a distinct increase in convenience and completeness of material contained, and improved service to mariners by greater frequency and regularity of issue.

VESSELS, URGENT NEED FOR REPLACEMENT.

The annual reports for 1919, 1920, and 1921 gave full statements of the urgent need for the construction of additional vessels for the Lighthouse Service to replace those worn out in service, those lost through various casualties, and to meet the considerable growth of the service. The duty of the two types of vessels, tenders for buoy work and supply purposes, and light vessels for floating lighthouses, was explained, as well as the severe usage and hazardous service to which these vessels are exposed.

These conditions have been alleviated for the present with regard to large seagoing tenders by the transfer to this service from the War Department of six mine-planting vessels which are being reconditioned for lighthouse work.

The need for new light vessels is increasing. There are no vessels in other departments or the Shipping Board available for transfer which are suitable for use as light vessels, due to their special design and construction. To maintain the serviceability of the light vessels it is necessary to construct an average of two each year. Since 1910, and particularly since the beginning of war conditions, there has been a considerable deficiency in the building of vessels sufficient to keep up this program.

Of the light vessels now in use 22 are more than 30 years old and 11 are over 50 years old. Many of the lightships are not in condition to be safely placed on exposed stations. The cost of repairs and overhaul becomes so heavy that it is not economical to keep in commission vessels after they have reached a reasonable limit of usefulness. The effect of continuing the use of these old vessels is often a greatly diminished output of work with the same or greater cost of operation and upkeep. Of more importance than the question of efficient and economical operation, however, is that of safeguarding life. Both lighthouse tenders and lightships are engaged on hazardous duty, and their officers and crews should not be required to serve on vessels which have passed a reasonable limit of usefulness, nor can the Lighthouse Service properly perform its part in the safeguarding of life and property on the navigable waters of this country without necessary vessel equipment.

Congress, by the act of June 5, 1920, after full hearings authorized a building program for vessels for the Lighthouse Service of \$5,000,000 and an appropriation of \$1,000,000 of this amount was made in the act of March 4, 1921. Under this and previous appropriations the following vessels are now under construction: Light vessels to replace *No. 20*, Cross Rip, Mass.; *No. 3*, Handkerchief, Mass.; *No. 11*, Scotland, N. J.; *No. 34*, Charleston, S. C.; and *No. 43*, relief, eighth district; tender to replace *Goldenrod*, fourteenth district. On the last contract much lower bids were received than for a number of years, and this appears to be a favorable time for vessel construction. No further vessels can be built, however, under available appropriations. During the fiscal year three tenders and four light vessels, which had been condemned as unfit for further service, were sold, the very small prices obtained indicating their extremely worn-out and unserviceable condition.

From careful estimates and examinations as to the condition and further serviceability of vessels of the Lighthouse Service it is found

that, in addition to those provided for by vessels now building, 14 light vessels and 5 tenders should be replaced within the next five years. As it will require from two to three years after appropriation is made before vessels are available for service, funds should be provided now for eight of these vessels, being those more urgently needed, and first named in the following list:

ADDITIONAL VESSELS FOR WHICH APPROPRIATION IS NOW NECESSARY OR SHOULD BE AVAILABLE WITHIN THE NEXT THREE YEARS.

Light vessel to replace No. 4, relief, second district, second class.....	\$200,000
Light vessel to replace No. 70, San Francisco, Calif., second class.....	200,000
Tender to replace <i>Oleander</i> , fifteenth district, river class (special).....	150,000
Light vessel to replace No. 57, Grays Reef, Mich., third class.....	150,000
Light vessel to replace No. 56, North Manitou Shoal, Mich., third class....	150,000
Light vessel to replace No. 51, relief, third district, completion, second class..	90,000
Recondition mine planter to replace <i>Lilac</i> , ninth district.....	35,000
Recondition mine planter to replace <i>Madrono</i> , eighteenth district.....	35,000
Light vessel to replace No. 5, Stone Horse Shoal, Mass., second class.....	200,000
Light vessel to replace No. 68, Fire Island, N. Y., second class.....	200,000
Light vessel to replace No. 69, Overfalls, Del., second class.....	200,000
Tender to replace <i>Holly</i> , fifth district, class B.....	300,000
Tender to replace <i>Arbutus</i> , fifth district, class B.....	300,000
Tender to replace <i>Daisy</i> , third district, class C.....	100,000
Light vessel to replace No. 48, Cornfield Point, Conn., second class.....	200,000
Light vessel to replace No. 1, Martins Industry, S. C., second class.....	200,000
Light vessel to replace No. 60, Eleven Foot Shoal, Mich., third class.....	150,000
Light vessel for Barnegat, N. J., second class.....	200,000
Light vessel off Grays Harbor, Wash., second class.....	200,000

GENERAL TYPES OF VESSELS PROPOSED.

Vessels.	Length (feet).	Construction weight.		Esti- mated cost.
		Tons.	Cost per ton.	
LIGHT VESSELS.				
Class 1, most exposed stations.....	147	615	\$406	\$250,000
Class 2, exposed stations.....	135	530	377	200,000
Class 3, Great Lakes stations.....	96	240	621	150,000
TENDERS.				
Class A, seagoing.....	190	1,000	400	400,000
Class B, coastwise.....	170	595	504	300,000
Class special, inland rivers.....	150	250	600	150,000

AIDS TO NAVIGATION.

During the fiscal year ended June 30, 1922, there was a net increase of only 18 in the total number of aids to navigation maintained by the Lighthouse Service, this being the smallest increase in a number of years, due to the large number of aids discontinued. There was an increase of 32 lights, 9 gas buoys, and 4 float lights, and a decrease of 27 unlighted aids. On June 30, 1922, there were maintained by the Lighthouse Service 16,373 aids to navigation, including 5,799 lights of all classes and 596 fog signals (not including 150 buoys with whistles and 391 buoys with bells), of which 4 are radio signals and 49 are submarine signals.

The table following gives a summary of the aids to navigation under each class established and discontinued during the fiscal year,

and also the net increase and the number in commission at the end of the fiscal years 1921 and 1922:

Class.	1922			Total, June 30—	
	Estab- lished.	Discon- tinued.	Increase.	1921 ¹	1922
Lighted aids:					
Lights (other than minor lights).....	57	36	21	1,858	1,879
Minor lights.....	131	120	11	3,044	3,055
Light-vessel stations.....				49	49
Gas buoys.....	66	57	9	629	638
Float lights.....	15	11	4	174	178
Total.....	269	224	45	5,754	5,799
Unlighted aids:					
Fog signals.....	9	7	2	546	548
Submarine signals.....	1		1	48	49
Whistling buoys, unlighted.....	1	3	² 2	76	74
Bell buoys, unlighted.....	8	10	² 2	248	246
Other buoys.....	300	289	11	7,193	7,204
Day beacons.....	87	124	² 37	2,490	2,453
Total.....	406	433	² 27	10,601	10,574
Grand total.....	675	657	18	16,355	16,373

¹ Differences from statistics published in 1921 report are due to minor discrepancies in previous count.

² Decrease.

Improvements in aids to navigation in the service generally have been made during the year, as follows: Thirty-five fixed lights were changed to flashing or occulting (including 3 light vessels), the illuminant of 1 light was changed to incandescent oil vapor, the illuminant of 65 lights (including 2 light vessels and 27 lighted buoys) was changed to acetylene, the illuminant of 9 lights (including 1 light vessel) was changed to electric incandescent. As shown above, 657 aids to navigation of the various classes stated were discontinued during the year. The discontinuance of further aids is under investigation from time to time as the original necessity for their maintenance ceases, and in that event they are promptly put out of commission, in the case of lights with the approval of the Secretary of Commerce.

Fog signals were established at four important stations and the fog signals at nine important stations were improved by the installation of more efficient apparatus. Work was continued during the year in repairing damage to aids to navigation caused by ice during the winter of 1917-18, especially to screw-pile structures in Chesapeake Bay and Potomac River. The work of repairing hurricane damage to aids in the Gulf of Mexico was also vigorously prosecuted during the year, including the replacement of damage on the coast of Florida from the storm of October 25, 1921.

General repairs required for upkeep of aids to navigation in efficient working condition were continued during the year so far as available funds permitted, but the funds available were not sufficient for the proper upkeep of this large amount of public property. Various special works were actively carried on during the year, including the establishment of important light and fog-signal stations, the construction of new light vessels and tenders, improvements in systems of fixed aids and buoyage, etc.

ALASKA.

During the year 49 new aids were established in Alaska. Nine new lights were established; 2 lights were changed from fixed to flashing; 1 gas and whistling buoy, 1 gas and bell buoy, and 1 gas buoy were established, also 3 unlighted buoys and 34 beacons.

The total number of aids to navigation in Alaska, including lights, gas buoys, fog signals, and day marks, in commission at the close of the fiscal year ended June 30, 1922, was 584, including 210 lights and 14 gas buoys, representing an increase of 187 lighted aids since June 30, 1910, or 505 per cent. The following table, which gives the total number of aids to navigation on June 30 of 1910, 1915, 1920, and of each succeeding year, illustrates the progress in establishing aids in the Territory:

Aids.	1910	1915	1920	1921	1922
Lights.....	37	112	196	206	210
Gas buoys.....			10	13	14
Fog signals.....	9	10	11	11	11
Buoys.....	84	167	224	225	225
Day marks.....	30	49	94	93	124
Total.....	160	338	535	548	584

GUANTANAMO, SAMOA, AND GUAM.

The aids to navigation in the outlying United States territory at Guantanamo Bay, American Samoan Islands, and the island of Guam are maintained under the supervision of the naval commanders by means of allotments made from the appropriations for the Lighthouse Service. Reports have been received from naval officers in local charge indicating that the aids have been properly maintained at an approximate annual expense as follows: Guantanamo, \$4,187; Samoa, \$1,127; Guam, \$2,465.

ADMINISTRATION.

The general organization of the service remained unchanged during the fiscal year.

The appropriations for the maintenance of the Lighthouse Service for the fiscal year 1923 are \$383,710 less than the estimates submitted and \$95,000 less than the total maintenance appropriations for the preceding fiscal year, 1922. Although Congress appropriated the amount estimated for by the department for the current fiscal year, under general expenses, Lighthouse Service, this estimate had been curtailed on account of the appeals of Budget officers for economy and retrenchment by the Government, and was \$400,000 less than the amount appropriated for the year last preceding the submission of the estimates. Therefore, notwithstanding the downward trend in prices of certain materials and supplies, much important and necessary repair work which has been accumulating during the past several years because of lack of funds, will have to be again deferred owing to insufficiency of the current appropriation.

A readjustment was made of pay scales on vessels of the Lighthouse Service on the Atlantic and Pacific coasts and the Great Lakes and a

system of longevity pay for all officers was introduced. The longevity system for crews, which had been in force on coast vessels for about a year, with satisfactory results, was extended to the crews of vessels on the Great Lakes.

Various economies effected in the maintenance of the service have been mentioned under that head.

Arrangements were made with the Navy Department for the transfer from that department to the Lighthouse Service of the operation of the radio stations on light vessels. Heretofore, this service was maintained by the detail of Navy radio operators and the installation by the Navy Department of radio equipment on the light vessels. During the last two years, however, the Navy Department had not been able, because of a shortage of personnel, to maintain the service on all of the light vessels equipped.

After careful consideration and full conference a plan was agreed upon between the departments for the transfer of the maintenance of the light-vessel radio stations to the Lighthouse Service, and this had been largely carried out at the end of the fiscal year. It is proposed to maintain radio communication with 20 of the more important light-vessel stations, requiring operators, also for 6 relief light vessels.

In accordance with its policy of cooperation, the Lighthouse Service has taken advantage of opportunities to render service to other Government agencies in various ways during the year, where this has been practicable. The service also encourages in its personnel the rendering of aid to those in distress, and many instances have been reported during the year of the saving of life and property or the rendering of valuable aid, often at great risk to the lighthouse keepers and other employees of the Lighthouse Service.

A conference of the superintendents of the sixteen coast and lake lighthouse districts and the principal officers of the Lighthouse Service was held in Washington, October 17 to 21, 1921. All of the superintendents were present, including those in charge of the Alaska, Hawaii, and Porto Rico districts. There was a general consideration of technical and administrative problems affecting the service and interchange of experience and results. Committees considered and reported on the more important topics. An interesting feature of the meeting was a visit to the Bureau of Standards, where opportunity was given the superintendents to examine new methods and apparatus connected with radio development, light, and sound.

Systematic inspections have been continued in the various lighthouse districts of the technical work, business methods, and property accounts.

ENGINEERING CONSTRUCTION.

The more important items of construction completed during the fiscal year were the new lighthouse depot at Chelsea, Mass., so far as the funds available from the special appropriation permitted; improving the wharves at the General Lighthouse Depot, Staten Island, N. Y.; improving aids to navigation in the vicinity of Joe Flogger Shoal, Delaware River; aids to navigation, Mississippi River below New Orleans; installation of an air diaphone fog signal at Galveston Jetty Light Station, Texas; rebuilding Point Jiguero Light Station, Porto Rico, which had been destroyed by earthquake; and keepers' dwellings at Poverty Island Light Station, Michigan, South Pass

Range Rear Light Station, Louisiana, and Diamond Head Light Station, Hawaii.

Other important works in progress at the close of the fiscal year included the following: Improving aids to navigation in Hudson River, N. Y.; a light and fog-signal station at Great Salt Pond, R. I.; enlarging the machine shop at the General Lighthouse Depot, Tompkinsville, N. Y.; riprap protection for certain light stations in the third lighthouse district; repairing and rebuilding aids to navigation, Atlantic coast, damaged by storm and ice; aids to navigation, Eastern Shore of Chesapeake Bay, Md. and Va.; additional gas buoys, fifth lighthouse district; improving and establishing new aids, St. Johns River, Fla.; improving and establishing new aids on Florida Reefs, Fla.; a dwelling for Dry Tortugas Light Station, Florida; repairing and rebuilding aids to navigation, seventh and eighth lighthouse districts; repairing and rebuilding aids to navigation, Gulf of Mexico, damaged by hurricanes; a new light station at Sabine Pass Jetty, Louisiana; riprap protection at Sand Island, Ala.; improvements to aids to navigation at Conneaut Harbor and Fairport Harbor, Ohio; establishing aids to navigation in Detroit River, Mich.; repairs to pier at Spectacle Reef Light Station, Michigan; improving aids in St. Marys River, Mich.; improvements to aids to navigation at Indiana Harbor, Ind., and Chicago Harbor, Ill.; improvements at Detroit, Mich., Lighthouse Depot; lighthouse depot, sixteenth lighthouse district; aids to navigation, Alaska; aids to navigation, Coquille River, Oreg.; and in Washington and Oregon; keepers' dwelling at Yaquina Head, Oreg.; and light station at Point Vincente, Calif. These works are described on pages 42 to 47.

During the year arrangements were made for the transfer to the Department of Commerce of a double dwelling and its site, owned by the United States Shipping Board at Lorain, Ohio, to be used as dwellings for the families of two of the keepers at Lorain Light Station.

During the year a committee consisting of the superintendents of the fifth, sixth, seventh, and eighth districts was designated to investigate the relative efficiency and economy of types of minor light structures in those districts. The purpose of the investigation was the formulation of a plan for greater uniformity of design and to determine the most efficient types of structures to meet requirements in this region, where a large number of structures for minor lights are in service. Over 50 lights in the navigable waters between New Orleans and Baltimore were carefully inspected and conditions noted as to nature of bottom, erosion at foundation, depth of water, range of tide, and exposure to damage by sea, wind, ice, etc. Much valuable information was obtained during this inspection, not only in connection with the problem under consideration but also in the opportunity afforded to study the general methods, practices, and equipment in each of the districts visited. At the conclusion of the inspection tour the committee submitted a report covering their findings, with recommendations as to the type and kind of material best adapted for structures under various conditions of locations, exposure, permanency, etc.

IMPROVEMENTS IN APPARATUS AND EQUIPMENT.

In addition to the 3 initial radio fog-signal installations made during the fiscal year 1921, and explained in detail in the annual report for that year, radio fog-signal stations were placed in commission on 2 light vessels, and the materials ordered for similar installations on 10 other light vessels, including 4 relief light vessels, and at 1 light station. New light vessel 105, completed during the year, was also equipped with radio fog-signal apparatus.

At the end of the year 46 light vessels and 29 tenders were equipped with radio-communication apparatus, these installations having been made largely during and since the war. Radio equipment on vessels of the Lighthouse Service has proved of material value in the operation of the service.

Improvements in intercoastal communication by the installation of telephones at light stations were continued during the year by the Coast Guard. On June 30, 1922, 311 light stations had telephone connections.

Special attention has been given to the installation of storage tanks for kerosene at depots and light stations and the purchase of the kerosene locally in bulk, as described elsewhere in this report.

As a large part of the apparatus and equipment used by the Lighthouse Service is of a special character, for which there is no commercial demand, improvements depend chiefly on the work of the personnel of the service. It is therefore the policy to encourage experiments and tests in the various districts, where problems present themselves. Although no funds are set aside and no special personnel employed for this purpose substantial progress is made from year to year as the result of efforts in the various districts and in the bureau's office along this line. Among the more important improvements which have received attention during the fiscal year in the interest of efficiency and economy of operation are the following:

A special type of lighted and bell buoy, having an automatic striking mechanism operated by compressed carbon dioxide, and weighing 18 tons when fully equipped with illuminating and fog-bell apparatus, has been designed to relieve Tail of the Horseshoe Light Vessel, in the fifth district.

On several occasions it has been found desirable to establish a bell buoy at a location near enough to an existing bell buoy but which may cause a confusion of sounds. To avoid this danger a gong buoy was designed which works on the same principle as a bell buoy but which gives an entirely different sound. This gong buoy has been placed on station and has proved so satisfactory to mariners that steps are being taken to design a larger set of gongs for use with larger buoys.

A hygroscopic controlling device for fog signals has been developed in the fifth district, and is now connected experimentally so as to control the electric driven 2,000-pound fog bell at Lazaretto Lighthouse Depot. The device automatically starts and operates the fog bell during fog and periods of low visibility such as rain, mist, and snow.

During the year acetylene lanterns, which have heretofore been purchased from the manufacturers, have been made at the General

Lighthouse Depot at a considerable saving and have been found satisfactory.

After prolonged laboratory and service tests of artificial-silk mantles for use in incandescent oil-vapor illuminating apparatus, it has been found that the silk mantles are more efficient and economical than the cotton mantles heretofore used, and they are now being used.

The work of converting oil-gas buoys to adapt them to the use of acetylene has been carried on during the year, as a measure of efficiency. The use of acetylene and electric welding apparatus has been extended to cutting and fitting new parts as well as welding broken or worn parts, etc. Encasing piles with concrete, against damage by the teredo, has proved satisfactory. Carbon dioxide cooling plants have been installed on lighthouse vessels, replacing the use of ice and ice boxes.

A test was made at the General Lighthouse Depot of a high-power vertical-beam searchlight, with a view to determining its usefulness as an aid to navigation.

The use of primary electric batteries and small incandescent lamps for minor lighted aids is being investigated, the object being to develop a reliable and economical substitute for oil lamps, thus reducing the cost of attendance and supplies and increasing the efficiency of the aids. An experimental installation is now under test at the General Depot.

PERSONNEL.

On June 30, 1922, there were 5,985 persons employed in the Lighthouse Service, including 89 technical, 155 clerical, and 5,740 employees connected with light stations, vessels, and depots. This is a net increase of 62 during the fiscal year. This service is charged with the maintenance of aids to navigation along 49,012 statute miles of general cost line and river channel.

The table below gives the number of employees (all authorized employees, including some vacancies) of the Lighthouse Service at the end of the fiscal year and a comparison of the totals with those for the previous fiscal year.

Of the positions in the table 56 are statutory and 5,929 are paid from lump-sum appropriations. Of the latter, however, the average pay of the light keepers (1,445) is fixed by law at \$840.

The annual report of the United States Employees' Compensation Commission for the fiscal year ended June 30, 1921, gives the number of reported cases of injury subject to compensation for the calendar year 1920 of employees of the Lighthouse Service, sustained while in the performance of duty and resulting in death and disability, as follows: Cases resulting in death, 8; cases resulting in permanent total or partial disability, 8; and of temporary total disability, 117. This number as compared with that for all other branches of the department combined, for the period stated, indicates the hazardous nature of the field work of the Lighthouse Service. It is believed that the authorized maximum compensation for disability on account of injury is too low, and that congressional action is desirable to provide a more adequate scale of compensation for employees who have lost their earning power because of disability through injury sustained while in the performance of duty.

EMPLOYEES IN THE LIGHTHOUSE SERVICE ON JUNE 30, 1922.

District.	Bureau officers, engineers and draftsmen, district superintendents, draftsmen, and technical assistants.	Clerks, messengers, janitors, and office laborers.	Depot keepers and assistants, including laborers.	Light keepers and assistants.	Laborers, light attendants, and lamp-lighters (appropriation "Salaries, keepers of lighthouses").	Light attendants and lamp-lighters (appropriation "General expenses").	Custodians of reservations.	Officers and crews on tenders and light vessels.	Field force for construction and repair (registered).	Field force for construction and repair (unregistered).	Total.
Bureau.....	14	26									40
First.....	2	6	1	114	3	0	0	74	7	2	215
Second.....	3	7	10	78	8	0	2	242	8	3	361
Third.....	14	33	10	186	31	43	2	324	231	45	919
Fourth.....	3	5	3	52	1		8	33	8	7	120
Fifth.....	7	10	43	163	93	20		280	14	3	633
Sixth.....	4	7	3	55	9	24	0	146	15	3	266
Seventh.....	3	4	3	42	1	8	0	44	5	78	188
Eighth.....	5	9	15	112	34	41	0	122	14	0	352
Ninth.....	2	5	3	38	11	0	0	26	7	5	97
Tenth.....	4	5	2	69	2	0	1	28	13	20	144
Eleventh.....	5	6	5	151	8	2	1	110	17	22	327
Twelfth.....	5	6	5	147	20	2		102	7	24	318
Thirteenth.....	1	2				208		19			210
Fourteenth.....	1	2				539		14			556
Fifteenth.....	1	2				321		23			347
Sixteenth.....	3	5	1	35	0	29	0	54	2	18	147
Seventeenth.....	3	6	5	78	15	123	0	131	10	16	387
Eighteenth.....	4	6	7	106	12	6		99	5	10	255
Nineteenth.....	2	3	2	19	2			30	2	19	79
At large.....	4										4
Total, 1922.....	90	155	118	1,445	250	1,306	14	1,901	365	281	5,985
Total, 1921.....	94	154	118	1,474	255	1,395	15	1,864	323	231	5,923
Increase.....		1						37	42	50	62
Decrease.....	4			29	5	29	1				

¹ Includes 7 appointed employees.

² The figures reported in the Annual Report for 1921 have been corrected to agree with the latest reports.

COST-KEEPING SYSTEM AND RESULTS.

A cost-keeping system has been continued in effect throughout the fiscal year. The costs are based on the actual expenditures during the fiscal year, whether of money or supplies. The information from this cost-keeping system is useful in furnishing information as to the disposition of all appropriations for this service, in preparing estimates, planning work, effecting economies, and comparing the efficiency of different districts, vessels, light stations, apparatus, methods, etc.

A generalized summary of costs for the fiscal year ended June 30, 1922, follows, as derived from this cost-keeping system:

SUMMARY OF COSTS, LIGHTHOUSE SERVICE, FISCAL YEAR ENDED JUNE 30, 1922.

[Amounts are stated to nearest even dollar, causing occasional minor discrepancies in totals. Difference from total expenditures reported elsewhere is due to inclusion of bureau salaries, printing expenses, and adjustment of inventories of articles furnished from stock.]

TOTAL COSTS OF PRINCIPAL FEATURES.

Feature.	Maintenance expenses.				Betterment expenses.				Grand total.	Per cent.		
	Salaries.	Subsistence.	General supplies.	Incidental expenses.	Total.	Repairs and improvements.					New works.	Total.
						Hired labor.	Materials.	Contract work.				
Administration 1.....	\$439,835	\$38,575	\$22,448	\$8,578	\$509,436					\$509,436	5.2	
Distributive charges 2.....	1,682,563	338,830	955,911	42,656	3,019,860	\$140,816	\$125,872	\$155,803	\$463,539	3,908,890	39.6	
Aids to navigation 4.....	2,667,124	371,656	904,549	25,165	3,968,494	246,293	303,628	94,892	842,350	5,455,657	55.2	
Total.....	4,789,522	749,061	1,882,908	76,290	7,497,790	387,109	430,500	250,685	1,305,889	9,871,983	100.0	

TOTAL COSTS OF DETAILED FEATURES.

Offices.....	\$439,835	\$38,575	\$44,743	\$8,578	\$531,731	\$50,474	\$46,058	\$12,301	\$16,307	\$531,731	5.4
Depots.....	265,927		249,097	15,461	530,485					655,625	6.6
Tenders:											
Large.....	381,374	94,362	216,023	7,558	699,317	9,534	18,560	49,704		77,798	7.9
Medium.....	905,489	215,708	419,662	17,144	1,558,003	73,566	51,669	77,327	413,578	2,174,143	22.0
Small.....	129,773	28,760	48,834	2,393	209,760	7,242	10,585	16,471	33,654	277,713	2.8
Total.....	1,416,636	338,830	684,519	27,095	2,467,080	90,342	80,814	143,502	447,232	3,228,971	32.7
Light vessels:											
Exposed.....	319,291	58,749	96,008	720	474,768	12,307	28,509	25,122	352,192	418,130	9.0
Moderately exposed.....	207,340	37,482	34,143	146	279,111	1,665	8,768	4,863	103,620	398,027	4.0
Relief.....	102,527	20,420	29,778	189	152,914	3,717	6,697	17,857		181,185	2.0
Lakes.....	88,921	18,517	15,285	648	123,371	3,835	2,743	4,213		134,162	1.3
Total.....	718,079	135,168	175,214	1,703	1,030,164	21,524	46,717	52,055	455,812	1,608,272	16.3

Light stations:	463,632	73,397	126,719	4,230	667,978	40,808	43,730	13,968	29,856	128,362	796,340	8.1
Primary seacoast and lake lights.....												
All other lights (except post lights).....	1,180,368	163,069	277,018	13,601	1,634,056	138,082	163,299	15,924	298,128	615,403	2,249,459	22.8
Post lights.....	266,172	22	41,894	819	308,907	7,136	17,238	3,437	.....	27,811	336,718	3.4
Day marks and spindles..	9	.....	122	.....	131	1,375	3,433	816	.....	5,644	5,775	.....
Total.....	1,910,181	236,488	445,753	18,650	2,611,072	187,401	227,690	34,145	327,984	777,220	3,388,292	34.3
Buoys.....	38,863	.....	283,582	4,812	327,257	37,369	29,221	8,691	58,554	133,835	461,092	4.6
Grand total.....	4,789,522	749,061	1,882,908	76,299	7,497,790	387,109	430,500	250,695	1,305,889	2,374,193	9,871,983	100.0

¹ Includes offices, except expenses of publications.

- Includes offices, except expenses of publications.
- Includes transportation and other traveling expenses.

Includes depots and tenders; also item excepted above, charged to supplies.

* Includes light vessels, light stations, minor fixed aids, and buoys.

AVERAGE COST OF SELECTED FEATURES.

Average cost of—	Salaries.	Subsist- ence.	General supplies.	Incidental expenses.	Total mainte- nance.	Repairs and im- provements.	Total cost.
District office, exclusive of third	\$16,557	\$461	\$352	\$400	\$17,770	.....	\$17,770
District depot, exclusive of general depot	4,093	.....	1,696	234	6,023	\$2,460	8,483
Large tender, Pacific	37,339	9,823	22,595	569	70,326	3,922	74,248
Large tender, Atlantic	38,670	9,178	20,941	881	69,670	10,352	80,022
Medium tender	27,149	6,432	12,691	474	46,460	4,738	51,200
Exposed light vessel	15,964	2,937	4,800	36	23,738	17,610	41,348
Moderately exposed light vessel	10,913	1,973	1,797	8	14,690	806	15,496
Lake light vessel	7,367	1,543	1,290	54	10,238	899	11,137
Primary seacoast light station	3,091	489	845	28	4,453	657	5,110
Other light station (except post lights)	558	77	131	6	772	150	923
Post light, river district	102	.....	8	.....	110	1	111
Post light, other district	90	.....	30	1	121	26	147

APPROPRIATIONS AND EXPENDITURES.

The appropriations for the maintenance of the Lighthouse Service for the fiscal year 1923 were \$7,748,290, being \$95,000 less than those for the preceding fiscal year. These appropriations were \$383,710 less than the estimates submitted. The appropriations for special works for the fiscal year 1923 amounted to \$663,500 and included 8 items. The average appropriations for special works for the 10 preceding years, 1913 to 1922, inclusive, amounted to \$781,030.

During the fiscal year 1922 there were two estimates submitted to Congress for deficiency appropriations, in both cases for repairing damage caused by storms or severe weather conditions. One of these was in the sum of \$120,000 for repairing and rebuilding aids to navigation in the seventh lighthouse district, which were damaged or destroyed by the hurricane of October 24 and 25, 1921. Appropriation of \$60,000, or one-half the amount estimated, was made in the deficiency act approved March 20, 1922. The second item was for repairs and improvements to Stannard Rock Light Station, Mich., in the sum of \$50,000 on account of damage caused by ice during the winter of 1921-22; no appropriation was made by Congress.

The detailed estimates for the fiscal year 1924 are given on pages 61 to 79. The total amount for general maintenance is \$89,530 more than the appropriation for the present year. Efforts are constantly made to reduce expenditures and estimates, but the cost of materials, though reduced to some extent, has not declined sufficiently to permit a material reduction in funds needed for the support of the service, especially in view of the large amount of upkeep work which is becoming increasingly urgent because of inadequate funds during the past few years, and in order that the service may be maintained at a proper standard of efficiency an adequate appropriation is necessary.

Increases are urgently needed in the pay scales of the Bureau of Lighthouses in Washington, and for part of the district forces, and it is recommended that the estimates of appropriations submitted be given favorable consideration.

Estimates for 17 special works have been submitted, aggregating \$2,207,600, considering only group 1, of which items amounting to \$1,505,000 have been authorized by law. As only 8 items were appropriated for special works in 1923, out of 30 items submitted, this estimate includes a number of important works for which estimates were submitted in previous years but which have not been appropriated for. The estimates include 1 new lighthouse tender, and conditioning 2 mine planters for service as tenders, 5 new light vessels, 3 new lighthouse depots, or the completion of new depots, 2 items for establishing or improving aids in general localities, 8 items for improvements of harbor or channel lights and other aids, 2 items for establishing or completing light and fog-signal stations, and 1 item for establishing radio fog-signal stations.

In selecting and submitting estimates for these special works, believed to be most important, there were considered estimates submitted by officers in the various districts and others for new lighthouse and ship construction aggregating about \$6,625,000, which

amount, however, did not include most of the urgently needed vessel rebuilding program. Many items not included in the estimates for this year are thought to be meritorious, and the more important of them are included in Group 2 of the estimates for special works, submitted for consideration as the resources of the Government permit them to be taken up. Explanation of the necessity for each of the items of special works is included with the estimates.

The tables following give comparisons of appropriations and expenditures for the Lighthouse Service, beginning with the fiscal year 1919 and including the estimates for 1924:

APPROPRIATIONS, LIGHTHOUSE SERVICE, FISCAL YEARS 1919-1923, WITH ESTIMATES FOR 1924.

Item.	Appropriations.					Estimates.
	1919	1920	1921	1922	1923	1924
MAINTENANCE.						
Salaries, Bureau of Lighthouses.....	\$65,430	\$65,430	\$68,290	\$68,290	\$68,290	\$92,820
General expenses, Lighthouse Service	3,500,000	4,000,000	4,600,000	4,200,000	4,200,000	4,200,000
Salaries of keepers of lighthouses.....	1,194,432	1,300,000	1,300,000	1,300,000	1,300,000	1,300,000
Salaries, lighthouse vessels.....	1,265,000	1,775,000	1,870,000	1,800,000	1,700,000	1,700,000
Salaries, Lighthouse Service.....	580,000	383,000	400,000	400,000	400,000	460,000
Retired pay, Lighthouse Service....	30,000	65,000	71,000	75,000	80,000	85,000
Total for maintenance.....	6,434,862	7,588,430	8,309,290	7,843,290	7,748,290	7,837,820
Unexpended balances (obligations estimated).....	66,283	35,775	24,357	126,118		
SPECIAL WORKS.						
New light and fog-signal stations....	80,000	26,000				270,200
Light vessels.....		450,000		1,000,000		790,000
Lighthouse tenders.....		760,000				220,000
Keepers' dwellings.....		50,000				
Improvement of aids.....	795,000	393,000		13,500	553,500	490,100
Lighthouse depots.....	288,000	42,000			110,000	428,300
Total for special works.....	1,163,000	1,721,000		1,013,500	663,500	2,207,600
Total maintenance and special works.....	7,597,862	9,309,430	7,837,290	8,856,790	8,411,790	10,045,420

EXPENDITURES FROM APPROPRIATIONS, LIGHTHOUSE SERVICE, FISCAL YEARS 1918-1922.

[Actual expenditures, regardless of year of appropriation.]

Expenditures.	1918	1919	1920	1921	1922
For maintenance.....	\$6,246,088.83	\$6,694,537.90	\$8,583,292.14	\$9,594,466.98	\$8,895,452.87
For special works.....	499,633.24	880,958.40	1,006,501.26	1,185,355.26	1,296,763.87
Total.....	6,745,722.07	7,575,496.30	9,589,793.40	10,779,822.24	10,192,216.74

During the fiscal year 1922, employees of the Lighthouse Service were paid a total of \$905,759 (included in above total of expenditures, but not in appropriations) from the appropriation increase of compensation, Department of Commerce, in addition to salaries paid from lighthouse appropriations.

Benefits not included in the above statement were received by the Lighthouse Service from the following sources:

Medical treatment by the Public Health Service, without charge, was received by approximately 786 employees of the Lighthouse Service during the fiscal year for an aggregate of approximately 6,657 days.

LIGHTHOUSE DEPOTS.

The lighthouse depots are a very essential feature of the efficient conduct of the work of the Lighthouse Service; they are the supply, repair, and vessel headquarters for the various districts. The depots are well distributed along the coasts of the country, but it is important that various improvements be made to give much needed depot facilities.

Work on the construction of a new lighthouse depot at Chelsea, Mass., for the second lighthouse district, under an appropriation of \$85,000 made by act of July 1, 1918, was completed to the extent of the funds available. The work done during the year consisted of the construction of east and west slip docks, some rough grading on the reservation, and the construction of buoy skids and a chain platform. An additional appropriation estimated at \$71,000 will be needed to fully complete and equip this depot.

Under an appropriation of \$60,000 made by act of March 28, 1918, for repairs to the wharves at the General Depot, Staten Island, the work of replacing portions of the old wooden wharves by concrete decks having cast-iron pile columns, was completed.

The act approved March 28, 1922, appropriated \$60,000 for improvements to the wharf at the lighthouse depot, San Juan, P. R., and \$50,000 for completing improvements to the lighthouse depot, Detroit, Mich.

The act of June 20, 1918, authorized \$275,000 for improvements at the lighthouse depot at Portsmouth, Va., or establishing a new depot, but no appropriation has been made for this work. This is the principal depot of one of the largest lighthouse districts and is the headquarters for five tenders and two light vessels during the greater part of the year. The facilities for berthing these vessels are entirely inadequate, and the efficient operation of the vessels is much hampered in consequence. The inadequacy of space for storing and handling buoys also causes much delay and loss. Increased facilities for this depot are urgently necessary.

Provision is needed for improved depot facilities in several of the districts, in addition to the above, particularly at or near Newport, R. I.; Honolulu, Hawaii; Key West, Fla.; and New Orleans, La. Additional funds are needed for the completion of the important depots at Boston, Mass., Charleston, S. C., Ketchikan, Alaska, and Goat Island, Calif. The act of June 5, 1920, authorized \$60,000 for completing the lighthouse depot at Charleston, S. C., \$250,000 for a new depot at Key West, Fla., \$16,500 for two keepers' dwellings at Goat Island Lighthouse Depot, Calif., and \$120,000 for a new depot at Honolulu, Hawaii, but no appropriation has been made for these works.

LIGHTHOUSE TENDERS.

Fifty-six tenders have been in operation during the year, having steamed a total of 481,258 nautical miles, or an average of approximately 8,600 miles for each tender, in the work of maintaining buoys, carrying supplies and construction materials to stations, supplying light vessels with coal, water, etc.; also transporting officers and employees to stations or on inspection duty; as well as duty in cooperating with other Government services, and the saving of life and property when occasion required. The total quantity of fuel consumed by tenders during the year was 50,482 tons of coal, 50,812 gallons of gasoline, 3,835 gallons of kerosene, and 819,798 gallons of fuel oil. The total cost of maintenance of tenders during the year amounted to \$2,377,414, exclusive of the cost of repairs, which amounted to \$249,684.

Three new tenders, the *Oak*, *Hawthorn*, and *Aster*, were completed and put in commission, and three of the old tenders, the *John Rodgers*, *Mistletoe*, and *Jessamine*, which had been laid up during the year as unserviceable, were sold for nominal amounts. The new tenders *Oak* and *Hawthorn*, which were constructed under an appropriation of \$760,000 made by act of November 4, 1919, were completed and delivered to the Lighthouse Service at the end of December, 1921, and placed in commission on January 27, 1922, in the third district. The new tender *Aster* was constructed under an appropriation of \$20,000 made by act of July 1, 1916, and was completed and placed in commission January 17, 1922; this work was advertised four times before obtaining bids within the amount available.

After a survey of the surplus vessels available for transfer from other branches of the Government nine mine-planting vessels were transferred from the War Department without cost, these vessels being of a type suitable for the Lighthouse Service after necessary alterations are made: two of the small mine planters, the *Sundew* (formerly the *Edward C. Long*), in the seventh district after alterations, and the *Pyxie* (formerly the *R. B. Ayres*), in the third district without alterations, for use as a towboat. Two of the large mine planters, the *Spruce* (formerly the *Col. Garland N. Whistler*) and the *Speedwell* (formerly the *John V. White*), are being reconditioned for service in the third and fifth districts, respectively. The other mine planters will be held for service as required and as funds are available for their reconditioning.

The act of June 12, 1917, appropriated \$150,000 for a tender for the third district or elsewhere. It has been decided to use this appropriation for the construction of a tender for the fourteenth district to replace the tender *Goldenrod*, which is practically worn out. Bids for the new tender were opened August 15, 1922, and contract awarded.

In a recent examination made of the tender *Oleander*, operating on the lower Mississippi River, it was found that the condition of the hull was such as not to warrant the installation of new propelling machinery which is badly needed for this vessel. The vessel is in such condition that it must be replaced at the earliest practicable time.

A more detailed statement of the needs of vessels is given on pages 9 and 10.

The following tenders either have been extensively overhauled or such work has been started during the fiscal year 1922: *Anemone*, *Mayflower*, *Madrono*, *Aspen*, *Camellia*, *Azalea*, *Orchid*, *Laurel*, *Cypress*, *Magnolia*, and *Snowdrop*.

It is probable that during the current year extensive overhaul will be completed or undertaken on the following tenders: *Hibiscus*, *Zizania*, *Anemone*, *Mayflower*, *Larkspur*, *Elm*, *Pine*, *Cypress*, *Mangrove*, *Camellia*, and *Sumac*.

The following was the number of tenders of the Lighthouse Service on June 30 of the years specified, omitting vessels not having regular crews and those less than 50 feet in length: 1910, 51; 1915, 46; 1916, 47; 1917, 51; 1918, 51; 1919, 55; 1920, 55; 1921, 55; 1922, 56.

On June 30, 1922, the following was the status of the tenders: In actual service, 46; undergoing repairs, 8; laid up, 2.

LIGHT VESSELS.

The Lighthouse Service maintains light vessels on 49 stations. During the fiscal year 60 vessels were in commission, of which 12 are relief vessels, and they averaged 270 days on station for each vessel. The total cost of maintenance of light vessels during the year amounted to \$1,038,525, exclusive of repairs, which amounted to \$120,012. Many of these light vessels have passed the useful age of service, and some of them are in such condition as not to warrant repairs from an economical point of view.

New light vessel *No. 105*, constructed under an appropriation of \$450,000 made by act of November 4, 1919, was completed during the fiscal year and is being equipped for service at an early date on Diamond Shoals, N. C. Five new light vessels are in progress of construction, and at the end of the fiscal year ranged from 23 to 45 per cent completed. These vessels are being constructed under an appropriation of \$1,000,000 made by act of March 4, 1921.

The act of June 12, 1917, appropriated \$130,000 for a light vessel for Cape Charles, Va., or for general service, plans and specifications were completed, and bids invited for the construction of the vessel. The lowest bid received was greatly in excess of the appropriation. It is now proposed to construct a smaller light vessel for service on the Great Lakes with this appropriation, if practicable.

Four old light vessels—*No. 2*, relief; *No. 55*, Lansing Shoal, Mich.; *No. 61*, Lake Huron, Mich.; and *No. 62*, Bar Point Shoal, Mich.—were sold during the fiscal year, the total amount obtained being \$1,261, indicating their extremely poor and worn-out condition. Two of these had been condemned during the preceding fiscal year.

At the end of the fiscal year 46 light vessels were equipped with radio apparatus, including new light vessel *No. 105*. Five light vessels were also equipped with radio fog-signal apparatus, three of these having been so equipped during the fiscal year and the other two during the preceding fiscal year.

As stated elsewhere, a plan was agreed upon for taking over by the Lighthouse Service of the operation of radio on light vessels, heretofore maintained by detail of Navy radio men, and this was being carried out at the end of the fiscal year. The Lighthouse Service will maintain radio communication on 20 light-vessel stations, requiring in addition radio on 6 relief light vessels.

The following light vessels have either been extensively overhauled or such work has been started during the last fiscal year: *No. 53, No. 81, No. 86, and No. 90.*

It is probable that during the current fiscal year extensive overhaul will be completed or undertaken on the following light vessels: *No. 9, and No. 74.*

The following was the total number of light vessels and stations on June 30 of the years named:

Year.	Light vessels.	Light-vessel stations.	Year.	Light vessels.	Light-vessel stations.
1910.....	68	54	1919.....	65	50
1915.....	66	53	1920.....	62	49
1916.....	66	53	1921.....	64	49
1917.....	68	53	1922.....	61	49
1918.....	67	52			

Of the present light vessels 38 have self-propelling machinery and 22 are provided with sail power only. One has no means of propulsion.

SAVING OF LIFE AND PROPERTY.

During the fiscal year services in saving life and property were rendered and acts of heroism performed by employees of the Lighthouse Service on 124 occasions, a summary of which is given on page 51 et seq. Many of these acts were especially meritorious and the employees were individually commended by the Secretary of Commerce.

REPORT OF OPEN-MARKET PURCHASES.

In compliance with the act of June 17, 1910, there is submitted separately as a part of this report a list of purchases of materials and supplies for the Lighthouse Service made without obtaining bids under public advertisement, with the reasons for so purchasing.

LEGISLATION ENACTED AFFECTING THE LIGHTHOUSE SERVICE.

No special legislation affecting the Lighthouse Service was enacted during the fiscal year.

The appropriations for the maintenance of the Lighthouse Service for the fiscal year 1922 are shown in tables on page 21. No additional special works were authorized by Congress during the fiscal year.

The statistics as to the various classes of aids to navigation and fuller details on many of the subjects mentioned in this report will be found in the pages following.

Respectfully,

GEORGE R. PUTNAM,
Commissioner of Lighthouses.

To Hon. HERBERT HOOVER,
Secretary of Commerce.

STATISTICS AND ESTIMATES.

LIST OF OFFICERS OF THE BUREAU OF LIGHTHOUSES AND THE LIGHTHOUSE DISTRICTS.

OFFICERS OF THE BUREAU OF LIGHTHOUSES ON JUNE 30, 1922.

George R. Putnam.....Commissioner of Lighthouses.
John S. Conway.....Deputy Commissioner.
H. B. Bowerman.....Chief Constructing Engineer.
Edward C. Gillette.....Superintendent of Naval Construction.

Principal Assistant Engineer, Rudolph Zirpel.
Superintendent on general duty, E. M. Trott.
Chief Clerk, Thaddeus S. Clark.
Examiner, Thomas Flood.

SUPERINTENDENTS OF LIGHTHOUSE DISTRICTS JULY 1, 1921, TO JUNE 30, 1922.

District.	Name.	From—	To—
1st.....	C. E. Sherman.....	July 17, 1911	
2d.....	G. E. Eaton.....	Mar. 7, 1919	
3d.....	J. T. Yates.....	June 20, 1912	
4th.....	B. B. Dorry.....	July 1, 1919	
5th.....	H. D. King.....	Jan. 28, 1915	
6th.....	H. L. Beck.....	do.....	
7th.....	W. W. Demeritt.....	Aug. 22, 1913	
8th.....	E. S. Lanphier.....	July 1, 1919	
9th.....	F. P. Dillon.....	Sept. 7, 1920	
10th.....	Roscoe House.....	June 4, 1912	
11th.....	E. L. Woodruff.....	Aug. 19, 1912	
12th.....	C. H. Hubbard.....	May 1, 1918	
13th.....	Col. H. Burgess, Corps of Engineers, U. S. Army.....	June 9, 1919	
14th.....	Lieut. Col. W. P. Stokey, Corps of Engineers, U. S. Army..	Apr. 22, 1920	
15th.....	Col. Chris. L. Potter, Corps of Engineers, U. S. Army.....	Apr. 6, 1920	
16th.....	W. C. Ditrell.....	Aug. 22, 1913	
17th.....	Robert Warrack.....	Feb. 1, 1915	
18th.....	H. W. Rhodes.....	July 6, 1912	
19th.....	A. E. Arledge.....	Sept. 3, 1912	May 16, 1922
	R. R. Tinkham.....	May 17, 1922	

JURISDICTION OF LIGHTHOUSE SERVICE.

The United States Lighthouse Service is charged with the establishment and maintenance of aids to navigation and with all equipment and work incident thereto on the sea and lake coasts of the United States, on the rivers of the United States so far as specifically authorized by law, and on the coasts of all other territory under the jurisdiction of the United States, with the exception of the Philippine Islands and Panama. The total length of coast line and rivers under the United States Lighthouse Service, measured by steps of 3 miles, is approximately 49,012 statute miles.

LIMITS OF LIGHTHOUSE DISTRICTS AND ADDRESSES OF SUPERINTENDENTS OF LIGHTHOUSES.

District.	Limits of district.	Address of superintendents.
1st.....	Waters of Maine and New Hampshire.....	Press Building, Monument Square, Portland, Me.
2d.....	Waters of Massachusetts.....	Customhouse, Boston, Mass.
3d.....	Waters of Rhode Island, Connecticut, New York, and New Jersey northward of Cape May.	Lighthouse Depot, Staten Island, N. Y.
4th.....	Waters of Delaware seacoast and Delaware Bay and River.	Post Office Building, Philadelphia, Pa.
5th.....	Waters of Maryland, Virginia, and North Carolina to and including New River Inlet, N. C.	New Customhouse, Baltimore, Md.
6th.....	Waters of North Carolina, South Carolina, Georgia, and Florida from New River Inlet, N. C., to Hillsboro Inlet, Fla.	Old Post Office Building, Charleston, S. C.
7th.....	Waters of Florida from Hillsboro Inlet to Cedar Keys..	Federal Building, Key West, Fla.
8th.....	Waters of Gulf Coast from Cedar Keys, Fla., to mouth of Rio Grande, Tex., and Mississippi River below New Orleans.	Customhouse, New Orleans, La.
9th.....	Waters of Porto Rico and adjacent United States islands.	Insular Buildings, San Juan, P. R.
10th.....	United States waters of St. Lawrence River and Lakes Ontario and Erie.	Federal Building, Buffalo, N. Y.
11th.....	United States waters of Lakes St. Clair, Huron, and Superior, and Detroit River.	Post Office Building, Detroit, Mich.
12th.....	Waters of Lake Michigan and Green Bay.....	Federal Building, Milwaukee, Wis.
13th.....	Mississippi River above the mouth of the Missouri River, Minnesota, Illinois, Osage, Gasconade, and Missouri Rivers, St. Croix River and Lake.	Federal Building, Rock Island, Ill.
14th.....	Ohio, Tennessee, Kanawha, and Monongahela Rivers.	Customhouse, Cincinnati, Ohio.
15th.....	Mississippi River below the Missouri River to New Orleans, La., and Red River.	Old Customhouse, Third and Olive Streets, St. Louis, Mo.
16th.....	Waters of Alaska.....	Commercial Building, Ketchikan, Alaska.
17th.....	Waters of Washington and Oregon.....	Customhouse, Portland, Oreg.
18th.....	Waters of California.....	Customhouse, San Francisco, Calif.
19th.....	Waters of Hawaiian Midway, Guam, and American Samoan Islands.	New Federal Building, Honolulu, Hawaii.

LIGHTHOUSE DEPOTS MAINTAINED ON JUNE 30, 1922.

[The principal depot of the district is indicated by the larger type.]

District.	Location.	District.	Location.
1st.....	Bear Island, Me.....	8th.....	Fort San Jacinto, Galveston, Tex.
	LITTLE DIAMOND ISLAND, ME.		Mobile, Ala.
2d.....	CHELSEA, MASS.		PORT EADS, LA.
	Woods Hole, Mass.	9th.....	SAN JUAN, P. R.
3d.....	Atlantic City, N. J.	10th.....	BUFFALO, N. Y.
	Goat Island, R. I.		Erie, Pa.
	Juniper Island, Vt.		Maumee Bay, Ohio.
	New London, Conn.		Rock Island, N. Y.
	TOMPKINSVILLE, STATEN ISLAND, N. Y.		Sandusky Bay (Cedar Point), Ohio.
	Tucker Beach, N. J.	11th.....	DETROIT, MICH.
4th.....	EDGEMOOR, DEL.		Minnesota Point, Minn.
	Lewes, Del.		St. Marys River, Mich.
5th.....	Annapolis, Md.	12th.....	Charlevoix, Mich.
	Lazaretto Point, Md.		MILWAUKEE, WIS.
	Point Lookout, Md.	16th.....	KETCHIKAN, ALASKA.
	PORTSMOUTH, VA.	17th.....	Ediz Hook, Wash.
	Washington Wharf, D. C.		TONGUE POINT, OREG.
	Washington, N. C.	18th.....	GOAT ISLAND, CALIF.
6th.....	CHARLESTON, S. C.	19th.....	HONOLULU, HAWAII.
7th.....	Egmont Key, Fla.		
	KEY WEST, FLA.		

EXPLANATION OF TABLE ON PAGE 28.

The table of aids to navigation includes all those maintained by the Lighthouse Service, a total of 16,373. On page 28 are given facts regarding the private aids to navigation, 886 in number, maintained under authority. In the statistics relief light vessels and duplicate or auxiliary lights and fog signals are not counted, but double lights are counted separately when maintained on distinct structures or for distinct purposes. Buoys for the purpose of marking the positions of light vessels or larger buoys are not counted. Fog signals at light stations or on vessels are counted as separate aids, but not those attached to buoys, except in the case of submarine bells, which are counted as separate signals, whether on vessels or on buoys. Otherwise each buoy is counted only once, and if it is included in a higher class it is not in the lower class. Light-vessel lights are not counted separately.



DETAILS AS TO CHARACTERISTICS OF LIGHTS (NOT INCLUDING LIGHT VESSELS).¹

	1st dist.	2d dist.	3d dist.	4th dist.	5th dist.	6th dist.	7th dist.	8th dist.	9th dist.	10th dist.	11th dist.	12th dist.	16th dist.	17th dist.	18th dist.	19th dist.	Total.
Fixed white:																	
Sixth order and above...	31	29	49	16	58	27	4	29	5	18	26	23	1	3	2	4	325
Below the sixth order...	1	8	72	5	228	139	56	148	4	5	52	6	51	222	18	11	1,022
Lighted buoys.....		1	5					2		10	2	5	1	2		10	38
Fixed red:																	
Sixth order and above...	14	10	22	2	20	20	9	8	1	11	32	27		4		3	183
Below the sixth order...	5	9	98	6	96	79	39	117	8	16	60	17	6	104	22	9	687
Lighted buoys.....			6						1	12	4	2	5	1		5	36
Fixed green:																	
Sixth order and above...			1												1		2
Below the sixth order...									1								1
Flashing or occulting:																	
Sixth order and above...	15	16	39	30	30	22	14	10	12	21	43	17	8	25	34	7	343
Below the sixth order...	9	26	59	39	27	24	24	16	14	20	65	36	142	30	21	24	537
Lighted buoys.....	14	58	76	21	101	26	19	46	8	35	98	33	14	26	26	10	610
Fixed and flashing, sixth order and above.....	12	6	6		3	3	1	3	3	2	9	14		3			65
Candlepower:																	
50,000 to 190,000.....	5	4	4	7	4	6	5	5	3	4	8	2	1	2	9	1	70
200,000 to 490,000.....		1	2	1	1	1	1	1			4	1	1	1	2	1	18
500,000 and over.....		1	1												1	1	4
Twin light stations.....	2	3															5
Stations with resident keepers.....	70	47	110	32	81	23	13	50	18	35	66	64	11	34	39	11	704

DETAILS AS TO ILLUMINANTS OF LIGHTS (NOT INCLUDING LIGHT VESSELS).¹

	1st dist.	2d dist.	3d dist.	4th dist.	5th dist.	6th dist.	7th dist.	8th dist.	9th dist.	10th dist.	11th dist.	12th dist.	16th dist.	17th dist.	18th dist.	19th dist.	Total.
Incandescent oil vapor.....	28	25	39	19	20	15	11	13	13	8	36	28	5	25	26	6	317
Oil (wick lamps):																	
Sixth order and above...	43	29	74	6	67	43	12	30	3	33	29	37	1	1	2	7	419
Below the sixth order...	6	9	152	5	310	217	94	235	4	16	66	18	52	310	35	14	1,543
Lighted buoys.....								2	1	22	6	5	6	3			45
Acetylene:																	
Sixth order and above...		1	2	14	13	15	4	7	4	5	18	4	3	2	2	1	95
Below the sixth order...	9	26	72	41	27	24	24	46	8	18	53	35	143	19	19	24	500
Lighted buoys.....	7	35	64	11	64	26	17	22	4		28	18	14	23	14	25	336
Oil gas:																	
Lights with mantles....											46						46
Lights without mantles.....					14						1						15
Lighted buoys with mantles.....	2		8	2	37			2	2	35	70	15		3	8		184
Lighted buoys without mantles.....	5	24	15	8			2	22	4			2			4		86
Electric arc:																	
Sixth order and above...															1		1
Electric incandescent:																	
Sixth order and above...	1	4	3	9	11		2		5	12	20	11		7	6		91
Below the sixth order...		8	3	4					7	7	16	4	1	27	7	6	90
Gas (coal), sixth order and above.....		2															2
Gas (oil), below sixth order.....			1														1
Five-day lens lanterns.....	4	4	15	2	16	38	37	97		9	16	6	3	7	22	16	292
Eight-day post lanterns.....		2	83		303	71	76	80	5		54		57	147	15		893

¹ Does not include the 13th, 14th, and 15th lighthouse (river) districts, in which there are 1,726 lights on fixed aids and 132 lights on floating aids, all of which use kerosene and are fixed, excepting 8, which use acetylene and are flashing, and 1 which uses electricity.

LIGHTS WHERE ILLUMINATION WAS IMPROVED DURING THE FISCAL YEAR 1922—Continued.

FLASHING OR OCCULTING LIGHTS CHANGED FROM FIXED LIGHTS (35 LIGHTS)—Con.

District.	Location.	District.	Location.
6th.....	Skull Creek, S. C.	12th.....	St. Helena, Straits of Mackinac, Mich.
9th.....	Cardona Island, P. R.	16th.....	Point Craven, Peril Strait, Alaska.
11th.....	Lake Huron Light Vessel, 96, Mich.		Port Alexander, Chatham Strait, Alaska.
	Lake St. Clair Light Vessel, 102, Mich.	19th.....	Kailua, Hawaii Island, Hawaii.
	Portage Lake Ships Canals Range, Mich. (2 lights).		Lahaina, Maui Island, Hawaii.
	Rouleau Point Range, Portage Lake, Mich. (2 lights).		Makahuena Point, Kauai Island, Hawaii.
	Round Island, St. Marys River, Mich.		Napoopoo, Hawaii Island, Hawaii.
			Pauwela Point, Maui Island, Hawaii.

ACETYLENE OR OTHER LIGHTS CHANGED FROM OIL-WICK LIGHTS, ETC. (74 LIGHTS).

2d.....	Annisquam Harbor, Mass. (electric incandescent).	9th.....	Point Arenas Gas Buoy, 3, Vieques Passage, P. R. (from oil gas).
	Canal Entrance Gas Buoy, Mass. (from oil gas).		Windward Point, Guantanamo, Cuba (incandescent oil vapor).
	Menemsha Harbor Easterly Jetty, Mass.	10th.....	Lorain West Pier, Ohio.
	Oak Bluffs North Breakwater, Mass.		Waverly Shoal Gas and Bell Buoy, 1, Lake Erie, N. Y. (from oil gas).
	Plymouth Main Channel Gas Buoy, 3, Mass. (from oil gas).	11th.....	Duluth Range Rear, Minn. (electric incandescent from incandescent oil vapor).
	Round Rock Gas Buoy, 2, Gloucester, Mass. (from oil gas).		Lake Huron Light Vessel, 96, Mich. (electric incandescent).
	Vineyard Haven Breakwater, Mass.		Lake St. Clair Light Vessel, 102, Mich.
3d.....	Westport Harbor, Mass.		Marquette, Lake Superior, Mich. (electric incandescent from incandescent oil vapor).
	Barge Wreck Gas Buoy, N. Y. (from oil gas).		Portage Lake Ship Canals Range, Mich. (2 lights).
	Croton Point Gas Buoy, 2C, Hudson River, N. Y. (from oil gas).		Rouleau Point Range, Portage Lake, Mich. (2 lights).
	Cow and Calf Gas Buoy, 10A, Conn. (from oil gas).		Round Island, St. Marys River, Mich.
	Five-Fathom Bank Light Vessel, 79, N. J.	12th.....	Two Harbors, Minn. (electric incandescent from incandescent oil vapor).
	Fort Adams, R. I.		Calumet Bar Gas and Bell Buoy, CB, Lake Michigan, Ill. (from oil gas).
	Jeffreys Hook, N. Y.		Lee Point Gas and Bell Buoy, 4, Grand Traverse Bay, Mich. (from oil gas).
	Newport Harbor, R. I. (electric incandescent).		Little Gull Island Gas and Bell Buoy, 2, Mich. (from oil gas).
	Parsonage Point Gas Buoy, 28A, N. Y. (from oil gas).		Manitowoc Pierhead, Wis. (electric incandescent).
	Rockaway Shoal Southwest Point Gas Buoy, 4, N. Y. (from oil gas).		Northport Point Gas and Bell Buoy, 2, Grand Traverse Bay, Mich. (from oil gas).
	Scotch Caps Gas Buoy, 28SC, N. Y. (from oil gas).		Point Betsie, Lake Michigan, Mich. (electric incandescent from incandescent oil vapor).
	Shag Bank Gas Buoy, 5, Conn. (from oil gas).		Point Peninsula, Green Bay, Mich.
	The Cows Gas Buoy, 24, Conn. (from oil gas).		Rock Island Passage Gas Buoy, 2, Wis. (from oil gas).
4th.....	Christiana North Jetty, Del.		St. Helena, Straits of Mackinac, Mich.
	College Point, Pa.		Simmons Reef Gas and Bell Buoy, 2, Straits of Mackinac, Mich. (from oil gas).
	Fieldsboro, N. J.		Waukegan Shoals Gas Buoy, 3, Lake Michigan, Ill. (from oil gas).
	Leipsic River Range, Del. (2 lights).		Wind Point North Shoals Gas and Bell Buoy, 14, Wis. (from oil gas).
	St. Jones River Range, Del. (2 lights).	16th.....	Point Craven, Peril Strait, Alaska.
	Trenton Range, Pa. (2 lights).		Port Alexander, Chatham Strait, Alaska.
5th.....	Coan River Gas and Bell Buoy, 5, Md. (from oil gas).	19th.....	Diamond Head, Oahu Island, Hawaii (electric incandescent from incandescent oil vapor).
	Fort Carroll, Baltimore Harbor, Md.		Kailua, Hawaii Island, Hawaii.
	Goose Hill Channel Range Front, James River, Va.		Lahaina, Maui Island, Hawaii.
	Maryland Point Channel Gas Buoy, 35, Potomac River, Md. (from oil gas).		Makahuena Point, Kauai Island, Hawaii.
	North River Bar Range Rear, N. C. (from oil gas).		Napoopoo, Hawaii Island, Hawaii.
	Spring Garden Channel Gas Buoy, 10, Baltimore Harbor, Md. (from oil gas).		Pauwela Point, Maui Island, Hawaii.
	Willoughby Bank Gas Buoy, 17, Hampton Roads, Va. (from oil gas).		
6th.....	Skull Creek, S. C.		
8th.....	Galveston Gas Buoy, 5, Tex. (from oil gas).		
9th.....	Cardona Island, P. R.		
	Gallardo Shoal Gas Buoy, 1, P. R. (from oil gas).		
	Muhlenfels Point, St. Thomas Harbor, Virgin Islands.		

FOG SIGNALS ESTABLISHED AND IMPROVED DURING THE FISCAL YEAR 1922.

District.	Location.	Character.	
ESTABLISHED (4).			
3d.....	Jeffreys Hook, N. Y.....	Bell operated by clockwork.	
8th.....	Galveston Jetty, Tex.....	Air diaphone.	
	Trinity Shoal Gas and Whistling Buoy, La..	Submarine bell.	
18th.....	San Francisco Light Vessel, Calif.....	Radio.	
IMPROVED (9).			
		From—	To—
3d.....	Hunts Point, N. Y.....	Electric siren.....	Electric bell.
	Newport Harbor, R. I.....	Bell operated by clockwork.	Do.
10th.....	Conneaut Harbor, N. Y.....	do.....	Air diaphone.
11th.....	Lake Huron Light Vessel, Mich.....	6-inch steam whistle....	First-class air siren.
	Poe Reef Light Vessel, Mich.....	First-class air siren.....	10-inch steam whistle.
	Two Harbors, Minn.....	10-inch steam whistle....	Air diaphone.
12th.....	Point Betsie, Mich.....	Air whistle.....	Do.
	Poverty Island, Mich.....	Steam whistle.....	Do.
16th.....	Cape Hinchinbrook, Alaska.....	Air siren.....	Do.

PRIVATE AIDS TO NAVIGATION MAINTAINED ON JUNE 30, 1922.

[Under the act of June 20, 1906.]

District.	Lights.	Buoys.		Other unlighted aids.	Fog signals.	Total.
		Lighted.	Unlighted.			
1st.....			31	1		32
2d.....	41		52	7		100
3d.....	36	1	109	1	2	149
4th.....			2			2
5th.....	15	1	193	51		260
6th.....	2		10			12
7th.....	3		9	5		17
8th.....	21		24	11		56
9th.....			1			1
10th.....	26	4	3	1	1	35
11th.....	12	1	54	1		68
12th.....	29	3	9		8	49
13th.....		1				1
15th.....	3					3
16th.....	2		1			3
17th.....	1		19		3	23
18th.....	24	2	4	5	23	58
19th.....	15		2			17
Total.....	230	13	523	83	37	886

BRIDGES OVER NAVIGABLE WATERS LIGHTED ON JUNE 30, 1922.

[Under the act of Aug. 7, 1882, 22 Stat. 309.]

District.	Lighted bridges.	District.	Lighted bridges.	District.	Lighted bridges.
1st.....	21	7th.....	27	14th.....	188
2d.....	74	8th.....	419	15th.....	8
3d.....	220	10th.....	59	17th.....	55
4th.....	17	11th.....	53	18th.....	33
5th.....	160	12th.....	198		
6th.....	62	13th.....	80	Total.....	1,074

AIDS MAINTAINED UNDER CONTRACT DURING FISCAL YEAR 1922.

District.	Name of aids.	Annual cost.
1st.....	Kennebunkport Pier Light, Me.	\$150. 00
5th.....	Curtis Bay Range Lights, Md. (2).....	222. 00
	Edenton Harbor Range Lights, N. C. (2).....	100. 00
	Cape Charles City Harbor Northern Light, Va.	} 25. 00
	Cherrystone Inlet Channel Range Rear Light, Va.	
	North Jetty Light, Va.	
7th.....	Caximbas Pass and Big Marco Pass, Fla. (4 buoys).....	60. 00
	Miami Municipal Channel, Fla. (5 buoys).....	72. 00
10th.....	Lake Ontario and the St. Lawrence River, N. Y. (40 buoys).....	3, 000. 00
11th.....	Superior Bay, St. Louis Bay and River, Wis. and Minn. (34 lights).....	3, 300. 00
16th.....	St. Michael Canal and Apoon Pass, Alaska (32 buoys); Orizaba Reef Bell Buoy and Norton Sound (11 lights).	1, 104. 50
	Sitka Harbor Light, Alaska.....	60. 00

¹ For the three lights.

LIGHT VESSELS IN COMMISSION DURING THE FISCAL YEAR 1922.

Station	District	Tonnage or displacement	When built	Material of hull	Dimensions			Regular complement		Fog signal	Illuminant	Cost of repairs made during fiscal year	Cost of maintenance during fiscal year	Original cost	On station	
					Length over all	Breadth	Depth	Officers	Crew						Months	Days
74	Portland, Me.	1,445	1902	Wood	129 9	28 6	13 0	4	8	12" steam whistle b.	Acet.	\$51	\$17,874	\$88,806	12	...
3	Fort Kent, Me.	140	1852	do.	36 9	23 0	10 0	2	5	Bell	do.	103	9,442	12,000	12	...
4	Relief	104	1855	do.	27 7	20 0	10 0	1	0	Bell or horn	Oil	38	1,008	...	12	...
5	Stone Horse Shoal, Mass.	104	1865	do.	31 6	21 6	9 0	2	7	9" air whistle	Acet.	13	12,772	...	12	...
20	Cross Rip, Mass.	165	1867	do.	31 6	21 6	10 0	2	5	Bell	do.	29	7,961	25,040	8	10
9	Hedge Point, Mass.	104	1857	do.	31 2	28 2	9 6	2	7	8" air whistle b.	Oil	21	13,616	19,883	12	...
11	Longyard, Scotland, Mass.	387	1876	do.	120 6	26 9	11 0	3	6	First-class air siren b.	Acet.	389	14,878	33,000	11	7
42	Hen and Chickens, Mass.	410	1877	do.	121 7	26 6	10 6	3	7	10" air whistle	Oil	788	15,140	40,796	12	...
47	Pollock Rip, Mass.	1,470	1891	Comp.	120 10	26 6	11 0	4	7	12" steam chime wh. b.	do.	3,429	17,655	60,000	11	5
54	Boston, Mass.	1,375	1892	Steel	118 10	26 0	14 0	4	8	First-class air siren b.	Acet.	838	18,131	62,030	8	36
66	Great Round Shoal, Mass.	1,500	1896	Comp.	123 0	28 6	13 0	4	7	12" steam chime wh. b.	do.	2,034	20,102	69,282	10	...
73	Pollock Rip Shue, Mass.	1,693	1901	Steel	123 9	28 6	14 9	4	8	do. b.	Oil	2,691	19,399	79,872	9	29
85	Nantucket Shoals, Mass.	1,683	1907	do.	135 5	29 0	14 9	5	10	do. b.	El. inc.	616	31,429	99,000	10	16
86	Relief	1,683	1907	do.	135 5	29 0	14 9	4	6	do. b.	Oil	4,589	20,319	99,000	8	...
90	Relief	1,685	1908	do.	135 5	29 6	14 9	4	9	do. b.	Oil and elect.	2,473	22,227	107,213	5	23
11	Scotland, N. J.	320	1853	Wood	104 0	24 8	11 6	2	5	Bell	inc.	332	12,375	13,462	11	13
13	Bartlett Reef, Conn.	155	1854	do.	27 9	21 8	10 4	4	6	10" air whistle	Acet.	309	15,605	12,000	11	25
16	Relief	250	1854	do.	103 6	22 6	11 0	2	3	First-class air siren, 10" whistle. b.	do.	1,817	8,053	28,084	3	12
23	Ram Island Reef, Conn.	186	1857	do.	94 2	24 0	9 0	2	5	Bell	do.	9	9,914	7,500	12	...
39	Brenton Reef, R. I.	387	1875	do.	119 6	26 9	13 0	4	6	10" and 6" air whistle b.	do.	317	16,670	42,200	11	6
44	Northeast End, N. J.	197	1882	Iron	115 6	25 0	10 6	4	7	First-class steam siren b.	do.	1,117	17,850	50,000	10	20
48	Cornfield Point, Conn.	1,470	1891	Comp.	120 10	27 8	12 0	4	6	First-class air siren b.	Acet and oil	431	15,662	52,780	11	4
68	Fire Island, N. Y.	1,590	1897	do.	122 10	28 6	14 6	5	10	12" steam chime wh. b. (R)	Acet.	3,638	23,628	74,750	10	15
69	Overfalls, Del.	1,590	1897	do.	122 10	29 6	14 6	4	10	do. b.	do.	389	20,611	79,540	9	8
78	Relief	1,668	1904	Steel	129 0	28 6	14 9	5	8	10" steam whistle b. (R) steam siren and bell	do.	2,852	20,603	89,030	7	22
79	Five-Fathom Bank, N. J.	1,668	1904	do.	129 0	28 6	14 9	4	8	12" steam chime wh. b.	do.	5,065	20,874	89,000	10	24
87	Ambrose Channel, N. Y.	1,683	1907	do.	135 5	29 0	14 9	5	10	12" steam whistle b. (R)	El. inc.	4,402	25,488	99,000	11	1
46	Tail of the Horseshoe, Va.	1,401	1887	Steel	124 6	27 6	12 0	4	6	12" steam whistle b.	Oil	34	15,922	60,000	12	...
49	Relief	1,470	1890	Comp.	120 10	27 0	14 0	4	6	First-class air siren b.	Acet.	5,139	14,603	57,900	5	22

52	Fenwick Island Shoal, Del.⊙	1375	1892	Iron	118 10	26 6	14 0	180	4	9	12" steam wh. air siren ^b	do.	3,943	22,613	62,000	8	13
72	Relief⊙	1663	1900	Steel	123 6	28 6	14 0	350	5	10	12" steam chime wh. ^b	El. inc.	10,706	25,736	80,000	9	7
80	Cape Lookout Shoals, N. C.⊙	1668	1904	do.	129 0	28 6	14 9	350	4	10	do. ^b	Acet.	4,316	23,610	85,000	6	26
91	Winter-Quarter Shoal, Va.⊙	1685	1908	do.	135 5	29 0	14 9	400	4	10	do. ^b	do.	1,819	29,181	107,213	10	22
101	Cape Charles, Va.⊙	1360	1916	do.	101 10	25 0	13 2	200	4	7	First-class air siren ^b	do.	1,355	19,935	108,507	10	26
105	Diamond Shoals N. C.⊙	1825	1922	do.	146 3	30 0	14 9	475	5	10	12" steam chime wh. ^b	do.	6,117	437,404	...	...	...
1	Martins Industry, S. C.⊙	1228	1855	Wood	103 0	24 0	13 0	(*)	2	8	(R).	Oil	3,207	14,676	...	9	10
34	Charleston, S. C.⊙	1218	1864	do.	101 10	23 0	10 0	(*)	2	7	First-class air siren ^b	Acet.	2,321	13,143	...	12	...
53	Relief⊙	1375	1892	Iron	119 0	26 6	14 0	135	5	9	Air diaphone	do.	2,100	21,580	...	8	11
84	Brunswick, Ga.⊙	1683	1907	Steel	135 5	29 0	14 9	325	5	10	12" steam whistle ^b	do.	4,357	23,207	...	8	21
94	Frying-Pan Shoals, N. C.⊙	1670	1911	do.	135 6	29 0	14 9	363	5	10	do. ^b	do.	2,915	22,619	...	9	20
81	Heald Bank, Tex.⊙	1668	1904	do.	129 0	28 6	14 9	325	4	8	do. ^b	Oil	4,802	22,310	90,000	8	18
102	South Pass, La.⊙	1360	1916	do.	101 10	25 0	13 2	200	4	7	First-class air siren ^b	Inc. o. v.	1,964	17,764	110,065	8	4
75	Lake St. Clair, Mich.	160	1902	do.	83 9	24 0	9 6	(*)	2	2	Bell	Acet.	1,133	5,618	14,998	...	26
82	Relief	209	1912	do.	95 2	21 0	10 0	90	4	3	10" steam whistle ^b	do.	1,396	10,899	42,910	2	10
89	Martin Reef, Mich.	205	1908	do.	88 3	21 0	10 0	90	4	3	6" steam whistle ^b	Oil	770	10,322	37,500	7	24
96	Lake Huron, Mich.	170	1914	do.	101 0	23 6	11 5	(*)	3	4	First-class air siren ^b	El. inc.	92	9,581	71,292	8	...
99	Poe Reef, Mich.	215	1920	do.	91 8	22 0	10 7	125	4	3	10" steam whistle	Acet.	203	10,087	97,220	7	10
56	North Manitou Shoal, Mich.	130	1891	Wood	102 8	20 0	12 6	100	4	2	6" steam whistle ^b	Oil	678	8,783	13,600	7	4
57	Grays Reef, Mich.	130	1891	do.	102 8	20 0	12 6	100	4	2	do. ^b	do.	119	9,418	13,600	6	25
60	Eleven-Foot Shoal, Mich.	160	1893	do.	87 2	21 6	10 0	(*)	3	3	10" steam whistle ^b	do.	2,180	8,835	12,990	5	16
77	Peshtigo Reef, Wis.	155	1906	Steel	75 0	21 6	9 3	(*)	2	3	8" air chime whistle	do.	141	6,922	13,950	6	23
95	Milwaukee, Wis.	368	1912	do.	108 5	23 0	11 6	200	4	5	12" steam whistle	El. inc.	1,784	16,969	74,558	11	...
98	Lansing Shoal, Mich.	195	1915	do.	101 0	23 6	11 5	100	4	2	First-class air siren ^b	do.	2,139	11,006	87,025	6	5
103	Relief	310	1920	do.	96 5	24 0	11 9	175	4	5	10" steam whistle	Acet.	313	14,340	161,074	6	5
67	Umatilla Reef, Wash.⊙	450	1897	Comp	122 7	28 6	13 0	200	4	11	12" steam whistle ^b	Oil	1,959	25,073	69,750	8	16
88	Columbia River, Oreg.⊙	1683	1907	Steel	135 5	29 0	14 9	325	5	11	do. ^b	do.	1,636	26,455	90,000	9	7
92	Relief⊙	1685	1908	do.	135 5	29 0	14 9	400	3	5	do. ^b	do.	3,764	24,749	107,213	8	29
93	Swiftsure Bank, Wash.⊙	1685	1908	do.	135 5	29 0	14 9	400	5	11	do. ^b	do.	3,124	29,094	107,213	9	23
70	San Francisco, Calif.⊙	1590	1897	Comp	122 10	28 6	14 6	349	4	11	do. ^b (R)	El. inc.	5,389	21,665	79,000	7	28
76	Relief⊙	1578	1904	Steel	129 6	28 8	14 4	380	2	5	do. ^b	Oil	5,100	22,250	90,000	6	9
83	Blunts Reef, Calif.⊙	1668	1904	do.	129 0	28 6	14 9	380	4	11	do. ^b	do.	2,104	24,385	90,000	9	23

⊙ Equipped with radio.
^b Submarine bell.
¹ Displacement (salt water).

* Length between perpendiculars.
² Sail.
³ Wood sheathed.

* Displacement (fresh water).
⁴ No means of propulsion.
^(R) Equipped with radio fog signal.

TENDERS OF LIGHTHOUSE SERVICE IN COMMISSION DURING THE FISCAL YEAR 1922.

Name	District	Displacement		When built	Description		Dimensions			Mean draft		Indicated horsepower	Regular complement		Miles steamed	Coal consumed for all purposes	Cost of repairs	Cost of maintenance	Original cost
		Tons	Light		When built	Description	Length over all	Breadth	Depth	Light	Loaded		Officers	Crew					
Albatross	1	818	519	1898	Steamer, twin screw	Steel	190	30	16	11 0	13 3	1,000	7	27	12,708	2,015	\$5,927	\$72,055	\$184,613
Albatross	1	818	519	1888	do	Iron	161	27	12	9 1	10 9	650	6	22	9,912	1,417	6,631	57,105	48,739
Albatross	2	818	519	1908	do	Steel	190	30	16	11 0	13 3	1,000	7	26	12,967	1,930	6,811	68,616	191,999
Azores	2	818	519	1891	Steamer, single screw	do	154	25	12	6 6	9 0	400	6	22	10,758	902	7,142	53,049	79,792
Mayflower	2	670	431	1877	Steamer, twin screw	do	164	30	12	7 9	8 1	650	6	24	7,676	1,118	17,842	36,185	74,872
Shrub	2	818	519	1912	Steamer, single screw	Wood	106	29	13	6 5	6 9	300	2	13	6,835	591	3,052	28,708	42,000
Albatross	3	61	35	1892	do	do	80	14	5	4 0	5 0	60	2	5	5,049	123	336	11,523	6,500
Larkspur	3	738	431	1903	Steamer, twin screw	Steel	169	30	14	9 1	10 6	750	7	25	11,351	1,547	1,621	61,204	123,250
Albatross	3	800	431	1921	Steamer, single screw	do	160	30	14	6 6	9 0	700	4	23	3,795	477	6,558	19,795	378,510
Albatross	3	800	431	1921	do	do	160	30	14	6 6	9 0	700	4	23	3,248	480	4,512	19,109	378,352
Pansy	3	431	259	1878	do	Iron	152	25	11	7 7	7 11	250	4	18	6,042	734	2,065	39,251	48,739
Tulip	3	774	431	1908	Steamer, twin screw	Steel	190	30	16	10 7	13 9	1,000	7	27	16,198	1,909	4,869	64,438	191,658
Albatross	3	435	259	1872	Steamer, single screw	Wood	140	25	11	9 6	11 0	225	4	10	2,227	690	217	33,706	44,500
Albatross	3	259	156	1918	Oil, single screw	do	101	30	9	5 6	6 9	150	2	8	1,313	43	48	9,531	16,197
Pine	3	55	35	1918	Gasoline, single screw	do	61	15	6	4 3	4 4	50	2	2	2,969	2,563	48	9,531	16,197
Iris	4	519	606	1897	Steamer, single screw	Steel	153	30	10	8 7	9 10	800	5	20	8,907	885	194	45,521	84,407
Woodbine	4	85	107	1913	Gasoline, single screw	Wood	95	16	7	5 2	5 11	125	2	5	6,377	12,789	4,198	14,530	24,728
Columbine	5	429	643	1892	Steamer, single screw	Steel	155	27	15	9 6	12 3	800	7	24	14,946	1,321	1,088	57,780	58,288
Arbutus	5	396	545	1879	Steamer, twin screw	Wood	153	25	11	7 1	9 0	300	7	23	14,439	907	3,866	57,050	49,769
Holly	5	431	499	1891	Steamer, side wheel	Comp	176	24	10	7 0	8 6	400	5	18	9,985	768	4,571	41,804	41,911
Juniper	5	125	146	1903	Steamer, twin screw	Steel	95	18	8	4 6	5 0	200	4	8	5,856	152	3,204	23,085	29,425
Laurel	5	218	299	1915	Steamer, single screw	Wood	105	22	9	6 1	6 10	160	4	12	9,750	439	4,082	28,011	55,532
Maple	5	567	799	1893	Steamer, single screw	Steel	164	30	12	7 3	9 5	650	7	24	14,236	605	2,160	59,805	93,880
Orchid	5	818	1,081	1908	do	do	190	30	16	11 0	13 3	1,000	7	28	15,570	1,494	14,752	67,171	186,151
Cypress	6	790	1,080	1908	do	do	190	30	16	11 0	12 0	1,000	7	28	12,536	1,654	19,749	71,169	191,033
Mangrove	6	606	821	1917	do	do	164	30	12	7 2	8 6	550	7	24	12,739	1,719	4,346	61,469	74,908
Palmetto	6	136	170	1917	Gasoline, twin screw	do	90	22	8	3 9	4 0	160	4	8	5,621	12,708	2,998	22,632	27,087
Water Lily	6	29	39	1895	do	Wood	64	11	5	3 3	3 8	50	2	3	3,150	2,431	3,574	8,940	9,261

Ivy	7	736	916	1904	Steamer, twin screw	Steel	173	30	13	8	5	9	6	700	7	22	6,942	1,349	4,022	65,328	123,860
Snowdrop	7	30	41	1836	Gasoline, twin screw	Wood	60	11	5	2	10	3	7	32	2	2	2,564	1,963	1,004	3,575	9,700
Poinsettia	7	27	31	1915	Gasoline, single screw	do	50	16	6	2	5	2	9	50	2	3	6,389	7,890	850	10,618	6,500
Sundew	7	580	710	1919	Steamer, single screw	do	98	24	13	9	3	11	0	325	2	8	4,133	245	1,006	12,488	115,900
Gamellia	8	276	377	1911	Steamer, twin screw	Steel	117	24	10	5	10	7	7	280	4	17	6,301	784	4,067	37,984	57,412
Magnolia	8	685	877	1904	do	do	173	30	13	7	6	9	2	700	7	25	9,226	1,664	2,274	60,364	124,874
Sunflower	8	836	1,246	1907	do	do	174	31	15	9	8	12	2	900	7	27	10,617	1,785	10,103	74,563	124,958
Cosmos	8	57	61	1909	Gasoline, twin screw	Wood	75	15	6	3	9	4	0	100	2	3	5,446	8,542	2,761	10,569	.....
Aster	8	64	109	1921	do	do	75	21	7	3	8	5	7	70	2	5	1,683	1,926	1,056	7,245	19,000
Lilac	9	542	582	1892	Steamer, single screw	Steel	155	27	15	11	0	11	6	800	6	20	7,792	703	9,230	55,792	92,125
Crocus	10	681	1,035	1904	Steamer, twin screw	do	165	29	14	9	6	12	3	700	5	23	6,853	1,307	6,553	52,459	119,718
Amaranth	11	597	975	1892	Steamer, single screw	do	166	28	14	8	6	12	6	672	6	20	11,373	1,229	2,146	48,733	74,994
Aspen	11	353	415	1906	do	do	126	25	12	7	3	8	3	440	4	10	7,592	634	7,706	26,775	70,573
Clover	11	163	205	1899	do	Wood	93	22	7	5	4	6	4	140	4	8	7,668	384	1,102	21,809	.....
Marigold	11	477	696	1890	do	Iron	160	27	12	8	5	11	0	550	6	20	10,662	1,083	3,458	46,589	84,871
Hyacinth	12	493	914	1903	do	Steel	165	28	14	7	0	11	6	768	6	20	11,315	1,714	4,424	52,716	115,000
Sumac	12	600	887	1903	Steamer, twin screw	do	169	30	13	8	10	11	9	700	6	23	9,326	1,689	3,898	55,714	114,962
Dandelion	13	232	302	1893	Steamer, stern wheel	Wood	140	31	5	2	6	3	3	500	4	15	7,971	1,376	6,082	29,432	23,174
Goldenrod	14	194	283	1898	do	Steel	169	27	4	2	10	3	6	304	2	12	6,104	775	412	23,682	33,221
Oleander	15	463	548	1903	do	do	189	34	7	3	6	4	6	600	4	17	14,947	2,830	2,489	45,573	60,000
Fern	16	245	317	1915	Steamer, single screw	Wood	112	22	10	7	1	8	6	300	5	11	13,478	2,854	3,254	41,977	62,100
Cedar	16	1,245	1,970	1917	do	Steel	201	36	18	9	6	14	0	1,150	8	25	17,107	12,980	1,754	95,759	248,189
Heather	17	631	831	1903	do	do	179	28	15	9	6	11	6	685	7	20	8,883	1,760	2,103	58,744	118,568
Manzanita	17	774	1,000	1908	Steamer, twin screw	do	190	30	16	10	7	12	7	1,000	7	24	10,191	2,046	2,482	65,357	211,817
Rose	17	395	567	1916	do	do	127	24	11	7	0	9	4	330	5	16	10,323	3,654	1,748	43,958	92,135
Madrona	18	654	806	1885	Steamer, single screw	Iron	180	27	15	9	9	11	6	750	7	21	7,057	988	11,517	56,850	87,872
Sequoia	18	809	1,100	1908	Steamer, twin screw	Steel	190	30	16	10	11	13	5	1,000	7	24	9,836	1,412	9,710	64,180	213,499
Kukui	19	838	935	1908	do	do	190	30	16	10	11	13	6	1,000	6	24	4,824	1,006	5,849	61,327	213,880

⊙ Equipped with radio.

1 Light=without cargo and deck loads, and a minimum supply of stores, provisions, water, and coal or oil.

2 Loaded=bunkers or fuel-oil tanks full, all tanks, including trimming tanks, full; full stores and provisions, and an average maximum cargo and deck load.

3 Placed in commission Jan. 26, 1922.

4 Gallons kerosene.

5 Gallons gasoline.

6 Formerly junior mine planter Capt. Edward C. Long.

7 Completed and accepted Jan. 17, 1922.

8 Displacement (fresh water).

9 Barrels of fuel oil. 1 barrel=42 gallons.

NOTE.—The following vessels have been transferred from the War Department and are being altered into tenders as needed and funds permit: Spruce (formerly the mine planter Col. Garland N. Whistler), Speedwell (formerly the mine planter John V. White), Col. Albert Todd, Gen. Edmund Kirby, Gen. Wallace F. Randolph, John P. Story, Pyxie (formerly junior mine planter Gen. R. B. Ayers), Capt. A. M. Wetherill.

LIGHTHOUSE VESSELS SOLD DURING THE FISCAL YEAR 1922.

The following vessels were surveyed and condemned as unserviceable, and of no further use to the Lighthouse Service, and sold to the highest bidders on the dates and for the amounts named:

Tender *John Rodgers*, third district, April 27, 1922, \$909.

Tender *Mistletoe*, third district, April 27, 1922, \$1,550.

Tender *Jessamine*, fifth district, March 1, 1922, \$765.

Light vessel No. 2, relief, fifth district, March 1, 1922, \$76.

Light vessel No. 55, twelfth district, February 15, 1922, \$840.

Light vessel No. 61, eleventh district, August 8, 1921, \$145.

Light vessel No. 62, eleventh district, August 8, 1921, \$200.

All serviceable equipment was removed from these vessels prior to their sale and reserved for further use on other vessels of the service as may be needed.

DESCRIPTION OF VESSELS COMPLETED.

TENDERS "OAK" AND "HAWTHORN."—*Structure.*—The vessels are alike, being 160 feet over all, with a molded beam of 30 feet, and displace approximately 875 tons when floating at a mean draft of 9 feet 6 inches in salt water. They are built of steel and have a large open main deck space forward, a steel pilot house mounted on the forward end of the main deck house, and a house containing additional quarters on the after end. The main deck house extends from a point just forward of amidships aft.

A steel derrick mast and boom with necessary rigging is located just forward of the deck house, also a four-drum steam hoisting engine having a safe hoisting capacity of 20 tons is located in the after end of the cargo hold.

The vessels are constructed with short forecastle heads within which are contained the windlass space, store and lamp rooms on the main deck, and crew's quarters under.

Machinery.—The vessels are each propelled by one fore-and-aft triple-expansion steam engine of 700 horsepower, having cylinders 13½ by 22 by 36 inches diameter, with a common stroke of 24 inches, driving a right-handed cast-iron propeller 8 feet 4 inches diameter, with a pitch of 9 feet. Steam is furnished by one 3-furnace boiler of the Scotch type, using coal as fuel, operating at a working pressure of 200 pounds per square inch. The vessels are fitted throughout with all necessary modern appliances, including all necessary auxiliaries, electric-light plant, electric boat hoister, windlass, and steam hoisting engines capable of handling 20 tons with the booms and gear.

Quarters.—The complement of each vessel is 4 officers and 23 men. The officers' quarters are located in the main deck house aft, the inspecting officer's quarters in the upper deck house aft, and the master's quarters in the upper deck house forward. The mess room, galley, and ice box are also located in the main deck house. The petty officers' quarters are located aft, below the main deck, and the crew's quarters forward in the forecastle under the main deck.

Painting.—The vessels are painted black from the line of boot topping to the top of the main rail and including the forecastle head to deck, also the smokestacks and ventilators.

The houses, boats, and davits are painted white.

Cost.—These vessels were constructed under the act of November 4, 1919, appropriating \$760,000 for tenders and light vessels. They were built under contract with the Consolidated Shipbuilding Corporation, Morris Heights, N. Y., at a price of \$357,250 each. The construction was commenced on January 14, 1920. The total cost of the vessels, including their equipment, was \$756,862. These two steel tenders were completed and delivered to the Government on December 28 and 31, 1921, respectively, and assigned to service in the third lighthouse district, Staten Island, N. Y.

TENDER "ASTER."—*Structure.*—The vessel is 75 feet over all, with a molded beam of 21 feet and a displacement of 75 tons when floating at a mean draft of 5 feet 7 inches in salt water. The entire vessel is built of wood. A pilot house with trunk cabin is located aft and a trunk cabin is located forward. Two wooden derrick masts with booms are fitted, one forward and one aft, the forward boom swinging aft and the after one forward, the derrick and gear being operated by a gasoline hoisting engine. Provision has been made for the attachment of a pile driver at the side of the vessel amidships.

Machinery.—The vessel is propelled by two 4-cylinder Standard Motor Co. gasoline engines, of 35 shaft horsepower each, driving three-blade bronze propellers 32 inches diameter by 34 inches pitch. There is a gasoline engine driven electric-light plant and a similarly driven hoisting engine, steel gasoline and fresh-water tanks in hold.

Quarters.—Provision is made to accommodate two officers in the deck house above, four men in quarters below the main deck aft, and four men in the quarters below the deck forward, making provision for a total complement of two officers and eight men.

Painting.—The hull of the vessel is painted black, from the water line to the top of the rail. All deck structures are white.

Cost.—The vessel was constructed under the act of July 1, 1916, appropriating \$20,000 for constructing or purchasing and equipping a small tender for the eighth district. Contract was entered into April 27, 1921, in the sum of \$14,400 for constructing, equipping and installing the machinery in a 75-foot twin-screw wooden tender, the engines to be furnished by the Government, exterior to the contract. The vessel was completed and finally accepted January 17, 1922, and assigned to service in the eighth lighthouse district for use in the intercoastal waters of Louisiana and Texas. Amount expended to June 30, 1922, \$19,909.14.

LIGHT VESSEL "No. 105."—*Structure.*—The vessel is 146 feet 3 inches long over all, with a molded beam of 30 feet and a displacement of 825 tons salt water, and is built entirely of steel. It is a two-deck vessel, having a flush spar deck above a complete main deck. Above the spar deck forward, and built around the foremast, is a steel structure containing the raised pilot house, master's quarters, and acetylene gas storage room. A similar structure, built around the mainmast aft, is arranged to contain the radio instrument, storage battery room, and the accommodations for the radio operator. There are two steel tubular lantern masts each surrounded by a gallery and rail with a lens lantern secured on top of the masthead.

Illuminating apparatus.—The signal lighting apparatus consists of an acetylene gas burner with flashing device within each lens lantern, gas being supplied through piping from a battery of flasks secured in racks in the gas storage room.

Fog-signal apparatus.—There are three types of fog-signal apparatus consisting of (a) a 10-inch whistle, located on the forward side of the stack, the characteristic blasts being operated by a special design of steam-drive gear located below; (b) a submerged submarine bell giving the same characteristic as the whistle and operated by electric driven machinery of special design; (c) a radio fog-signal apparatus giving a characteristic radio signal which can be picked up readily by any vessel having a receiving apparatus and is particularly valuable to those equipped with the radio compass, for such vessels may locate their position very accurately by this means.

Machinery.—The vessel is propelled by fore-and-aft compound steam engines of 475 horsepower with cylinders 16 inches and 31 inches by 24-inch stroke, making 140 revolutions, driving a right-hand solid cast steel propeller with a diameter of 8 feet 6 inches, and 9 feet 6 inches pitch. Steam is furnished by two oil-burning, single-end return, tubular Scotch marine boilers 10 feet 6 inches diameter by 11 feet 4 inches long with a working pressure of 120 pounds per square inch. The vessel is fitted throughout with the necessary modern appliances, including a steamboat hoister, electric lighting, system, mechanical refrigeration, radio receiving and transmitting apparatus, hot and cold water system, and up-to-date sanitary plumbing and drainage systems and fixtures.

Moorings.—The moorings consist of two 1½-inch stud-link chain cables of 120 fathoms each and two 5,000-pound cast-steel mushroom anchors.

Quarters.—The complement of the vessel is 5 officers and 10 men. The officer's and crew's quarters, galley, mess room, bathrooms, etc., are located on the main deck. The storerooms, provision locker, machinery stores, etc., are located on the lower deck, forward and aft of the machinery space.

Fuel and fresh water.—The vessel is equipped with large fuel-oil bunkers located abreast of the boilers and a series of structural fresh-water tanks located forward below the lower deck. The total capacity of fuel oil and water is sufficient to maintain the vessel on station for 12 months.

Painting.—The hull is red, ventilators and stack black, with DIAMOND in large white letters on each side.

Cost.—This vessel was constructed under act of November 4, 1919, appropriating \$450,000 for the construction of a light vessel for Diamond Shoal Light Vessel Station, N. C., to replace light vessel No. 71. The vessel was built at Morris Heights, N. Y., at a contract price of \$396,750. The construction was commenced January 24, 1920. The total amount expended to June 30, 1922, was \$426,872. This new light vessel was completed and delivered to the Government on April 8, 1922, at Tompkinsville, Staten Island, N. Y., where radio apparatus is to be installed, and will then proceed to Baltimore for installation of submarine signal apparatus, when it will be assigned to its station on Diamond Shoal, N. C.

PROGRESS OF VESSELS UNDER CONSTRUCTION.

Light Vessels "No. 106" to "No. 110."—The act of March 4, 1921, appropriated \$1,000,000 for lighthouse vessels. Plans and specifications were prepared and bids received for the construction of three, four, or five light vessels. The lowest bid received was \$200,000 each for three vessels and \$160,000 for each additional vessel up to and including five, or a total of \$920,000. A contract was awarded to the Bath Iron Works, Bath, Me., on July 8, 1921, and the work was immediately commenced. The degree of completion on each vessel on June 30, 1922, was as follows: *No. 106*, 45 per cent; *No. 107 and No. 108*, 34 per cent; *No. 109*, 24 per cent; *No. 110*, 23 per cent.

Tender "Sundew."—This vessel, formerly the junior mine planter *Edwin C. Long*, belonging to the War Department, and transferred to this service, was reconditioned at the third lighthouse district depot, and assigned to the seventh lighthouse district, Key West, Fla. The total cost of the work of alteration, etc., was \$2,453.73.

Tender "Greenbrier."—The act of June 12, 1917, appropriated \$150,000 for a lighthouse tender for the third district or for general service. After failure to secure a vessel for coast service following two advertisements, owing to the excessive bids received, it has been decided to use this appropriation for a tender for the Ohio River and tributaries. Plans and specifications have been prepared, and bids were opened August 15, 1922. Amount expended to June 30, 1922, \$543.04.

Light vessel, Cape Charles.—The act of June 12, 1917, appropriated \$130,000 for a light vessel for Cape Charles, Va., or for general service. Plans and specifications were prepared and bids invited for the construction of the vessel, but the lowest bid received was greatly in excess of the appropriation and all bids were rejected. Consideration will be given to utilizing this appropriation for a smaller vessel, if practicable to obtain bids within the amount of the appropriation. Amount expended to June 30, 1922, \$99.62.

Light vessels for general service.—There is a balance of approximately \$78,000 remaining under the appropriations of August 24 and 26, 1912, for light vessels. This balance is not sufficient to procure an additional light vessel at the prices now prevailing, but consideration may be given to requesting Congress for authority to combine this balance with other appropriations in order that it may be utilized for obtaining an additional light vessel, which is greatly needed.

DESCRIPTIONS OF IMPORTANT WORKS COMPLETED.

LIGHTHOUSE DEPOT, CHELSEA, MASS.

Appropriation July 1, 1918, \$85,000, for building a depot at Chelsea, Mass. A three-story and basement storehouse, 35 by 80 feet, of brick, with steel frame and reinforced concrete floors and roofs, and a brick oil house, 25 by 52 feet, of brick, with steel and asbestos siding roof, have been completed. A concrete chain platform, 85 by 105 feet, with strongback, has been laid. A new wharf containing 11,600 square feet, across the front, up the side, across the head of the easterly dock, and up 205 feet of the westerly dock, has been built, with a concrete retaining wall about 3 feet high behind the same. About 800 feet of buoy skids, supported on concrete piers, have been put in. A 4-foot concrete sidewalk from the street to the front wharf has been laid, a wooden fence and flagpole have been erected, a gasoline tank and a measuring pump have been installed, a conduit electric-lighting system for storehouse, yard, and wharf has been put in, and practically two-thirds of the rough grading, to an average depth of 16 inches, over nearly the entire depot, has been filled in. The work of the depot began in 1919 and was completed in June, 1922, at a total cost of \$84,967.58.

STATEN ISLAND LIGHTHOUSE DEPOT, N. Y.

Appropriation March 28, 1918, \$60,000, for repairing the wharves of the General Lighthouse Depot, Staten Island, N. Y. The work was divided into three sections: north wharf, south wharf, and bulkhead dock. The work consisted of removing the wooden decks and installing additional steel work, cast-iron pile columns, manhole frames and covers, pipe hangers, and laying new concrete decks on the north and south docks, and the replacing of 2,500 square feet of old wooden bulkhead dock with new concrete and steel dock. Work was started in September, 1918, and completed in August, 1921. Amount expended to June 30, 1922, \$59,760.67.

JOE FLOGGER SHOAL, DEL.

The act approved July 1, 1918, provided that the unexpended balance of the appropriation of \$40,000 "toward a light and fog-signal station on the Joe Flogger Shoal, Delaware River," contained in the act approved June 30, 1906, be made available for establishing gas buoys and improving aids to navigation in the vicinity of Joe Flogger Shoal, Del.

Under this authorization 10 modern gas buoys were manufactured and delivered, and the lighting of this shoal has been completed in an effective manner, with sufficient spare buoys for relief and renewals.

All the work contemplated under this appropriation was completed during the year, at a cost of \$39,948.33.

AIDS TO NAVIGATION, MISSISSIPPI RIVER, LA.

Appropriation July 1, 1916, \$50,000, for the improvement of aids to navigation on the Mississippi River, below New Orleans. The work accomplished consisted in the establishment of 25 lights on structural-steel towers which replaced 20 post-lantern lights and provided for the establishment of 5 new lights. The lights are from 38 to 42 feet above mean high water. The foundations for the towers are on the crown of the levee. The illuminant is acetylene in 200-millimeter lens lantern in the case of one light and oil lens lanterns in the case of 24 lights. Contract was entered into June 22, 1917, for furnishing 25 structural steel towers. Additional illuminating apparatus, etc., was secured and the work was completed in June, 1922, at a cost of \$49,729.66.

GALVESTON JETTY LIGHT STATION, TEX.

Appropriation March 4, 1921, \$6,500, for fog signal. The fog-signal apparatus is an air diaphone operated by a 6-horsepower kerosene-engine air compressor unit in duplicate. Bids were invited for fog-signal apparatus, etc., in March, 1921, and fog signal was established in December, 1921. Minor adjustments were made, and the work was finally completed in June, 1922. Amount expended to June 30, 1922, \$5,323.89.

LIGHT KEEPERS' DWELLING, SOUTH PASS RANGE REAR LIGHT STATION, LA.

Appropriation July 19, 1919, \$50,000, for constructing light keepers' dwellings and appurtenant structures, of which \$6,500 was allotted this district for building a keeper's dwelling at South Pass Range Rear Light Station. The dwelling is a single story, frame, 5-room structure, 25 by 36 feet, founded on 19 reinforced concrete piers with spread footings. Front and rear porches are also provided. Storm sheathing was placed diagonally under the weatherboards, and inside ceiling was used in all rooms. The roof is covered with asbestos shingles. The dwelling is screened throughout. The kitchen is provided with sink and pump, the water being supplied from a 10-foot diameter cypress cistern. One hundred and forty feet of walk was constructed to outbuildings in rear of dwelling and 75 feet of walk to connect with the walk at adjacent dwelling. Work was started in July, 1921, and completed in November, 1921, at a cost of \$5,922.66.

POINT JIGUERO LIGHT STATION, P. R.

Appropriation July 19, 1919, \$24,000, for rebuilding Point Jiguero Light Station, P. R., which was destroyed by earthquake. Bids for this project were in excess of the appropriation and the work was accomplished by district force, by hired labor and purchase of material. The tower is of reinforced concrete and consists of a cylindrical shaft 12 feet in diameter, with walls 1 foot thick, having a stepped base and supported on a square reinforced concrete foundation 4 feet thick. A spiral stairway of precast concrete steps extends from base to top, the inner ends of the steps being supported by a hollow concrete column. A 7-foot helical bar lantern will eventually surmount the tower and contains the lens apparatus which was removed from the old station, but for the present the old lantern is in use. The focal plane of the light is 55 feet above the ground, and 93 feet above high water.

The dwelling is a frame structure covered with asbestos shingles on the sides and roof. It contains a double set of quarters of four rooms each, with porches at each end. The dwelling is 63 feet long and 26 feet wide over all.

The light was placed in commission in the new tower on January 12, 1922.

The amount expended to June 30, 1922, was \$23,432.19.

LIGHT KEEPER'S DWELLING, POVERTY ISLAND LIGHT STATION, MICH.

Appropriation, July 19, 1919, allotment, \$6,500 for keeper's dwelling. The dwelling is of bungalow type, one story and basement, 24½ by 42½ feet with porch added. Walls are of hollow tile, with exterior white cement stucco, interior furred, metal lathed and plastered. Hip roof covered with 18-inch wide red slate surfaced, asphalt roll roofing. Floors are hard maple, the ceilings are insulated with mineral wool. Work was begun October 23, 1920, and completed in season of 1921; cost, \$6,500.

LIGHT KEEPER'S DWELLING, DIAMOND HEAD LIGHT STATION, HAWAII.

Appropriation, July 19, 1919; allotment, \$5,000 for keeper's dwelling. This dwelling is a frame structure, bungalow type, 28 by 46 feet, on moss rock foundation. Outside walls are of novelty siding and roofed with asphalt shingles. This dwelling provides quarters for one keeper. Work was commenced in May and completed in October, 1921, at a cost of \$4,986.49.

PROGRESS OF SPECIAL WORKS UNDER CONSTRUCTION.

[For projects on which no important progress has been made during the fiscal year reference is given to the latest Annual Report containing information as to status.]

SECOND DISTRICT.

Lighthouse Depot, Chelsea, Mass.—All work completed for which funds are available; for description see page 40.

Nantucket Harbor Fog Signal Station, Mass.—See Annual Report, 1920, page 44. During the past fiscal year a spare cable has been purchased and contract made for the delivery of 343 tons of riprap to strengthen the mound at the end of the east breakwater. The probable date of completion is July 30, 1922.

Light keepers' dwellings.—See Annual Report, 1920, page 44. Bids were again invited in December, 1921, but none were received. The erection of dwellings at Brant Point and Wings Neck Light Stations, Mass., has been indefinitely postponed.

THIRD DISTRICT.

Aids to navigation, Hudson River, N. Y.—See Annual Report, 1920, page 44. This project is complete excepting improvements to structure and illuminating apparatus of Fitch's Wharf Light. All material is on hand and work will be completed as soon as title to site is obtained.

Great Salt Pond Light Station, R. I.—See Annual Report, 1920, page 44. It is expected that the work will be completed one year after additional funds are provided.

Staten Island Lighthouse Depot, N. Y.—Appropriation July 19, 1919, \$30,000, for extending and enlarging the machine shop at the General Lighthouse Depot, Staten Island, N. Y., the present machine shop as constructed not being well adapted to the work which is done in it. It will have to be extended and enlarged before it can be made an efficient and economical shop. Bids for the erection of this building were opened on April 3, 1922. The bids received ranged from \$31,700 to \$49,000, and all bids were therefore rejected. It is proposed to readvertise for bids for this work later. It is expected this work will be completed in about 12 months after award of contract.

Staten Island Lighthouse Depot, N. Y.—*Repairing wharves.*—Work completed; for description see page 40.

Riprap protection for light stations.—Appropriation July 19, 1919, \$150,000, for riprap to reinforce foundations and protect them from damage by sea and ice, and to construct and improve boat landings at various light stations in the third lighthouse district. The total estimated cost of this work was \$283,775, but on account of the advance in the prices of riprap it has been found necessary to increase the estimate of cost to \$286,205. The light stations at which this riprap is to be deposited are practically all on submarine sites, and those not so located are subject to damage from the sea. Two lighters were purchased from the War Department at \$4,500 each, for the purpose of placing the riprap by hired labor. Riprap has already been installed or work is under way to protect and strengthen the foundations from further damage at Colchester Reef, Execution Rocks, Romer Shoal, Plum Beach, Old Orchard Shoal, Great Kills and Newark Bay Lights, and bids will soon be invited and work started at Race Rock and Little Gull Island Light Stations. Work was started in August, 1919, and it is expected will be completed about December, 1923.

FOURTH DISTRICT.

Joe Flogger Shoal, Del.—Project completed; for description see page 41.

Aids to navigation, Delaware Bay entrance.—Appropriation, March 28, 1922, \$138,000. Preliminary plans and estimates have been prepared and preparations made for active work in the coming fiscal year, at Brandywine Shoal, Harbor of Refuge, and Hen and Chickens Shoal. As appropriation is not available until July 1, 1922, no expenditures could be made.

FIFTH DISTRICT.

Repairing and rebuilding aids to navigation, Atlantic coast.—See Annual Report, 1921, page 50. The concrete foundation footings and piers of Old Plantation Flats Light Station were completed during the past fiscal year, and as soon as settlement takes place the foundation will be protected by depositing additional riprap. At Tangier Sound Light Station, Va., 262 tons of protection riprap were deposited.

Aids to navigation, Chesapeake Bay, Md., and Va.—See Annual Report, 1921, page 50. During the past year a gas and bell buoy and spar buoy were established at Swan Point and three-pile slatted structures built for Swan Creek Range Lights.

Gas buoys, fifth lighthouse district.—See Annual Report, 1921, page 50.

SIXTH DISTRICT.

St. Johns River, Fla.—See Annual Report, 1921, page 51. The submarine bell at the entrance to the river was replaced with a new and improved apparatus during the past fiscal year.

SEVENTH DISTRICT.

Repairing and rebuilding aids to navigation, seventh and eighth districts.—See Annual Report, 1921, page 51. During the past fiscal year, Sand Key Light Station; cast-iron stairs renewed, all material ordered for iron pile dock; and steel tanks ordered. Dry Tortugas Light Station; new and larger motor boat built; new concrete boathouse completed; lantern glass replaced; all material for wharf ordered and working party now at station. Preliminary plans for new iron structures to replace those destroyed on Florida Reefs and in Hawk Channel have been approved. All buoys and appendages have been delivered. Probable date of completion, June 30, 1923.

Repairing and rebuilding aids to navigation, seventh lighthouse district, 1922-23.—The act of March 20, 1922, appropriated \$60,000, for repairing, rebuilding, and reestablishing aids to navigation and structures connected therewith that were destroyed or damaged in the storm of October 24-26, 1921. Part of material has been ordered. Probable date of completion June 30, 1923.

Aids to navigation, Florida Reefs, Fla.—See Annual Report, 1921, page 51. Under this appropriation 45-foot iron skeleton towers were erected on Pacific Reef and Molasses Reef, Fla. Probable date of completion of other work under this appropriation, January 31, 1923.

Dwelling, Dry Tortugas Light Station, Fla.—The act of July 19, 1919, appropriated \$50,000 for light keepers' dwellings. The amount allotted the seventh district for this work is \$6,500. Design of dwelling was approved during the year. Working party and most of the material at station; dwelling was about 10 per cent completed on June 30. Probable date of completion, December 31, 1922.

EIGHTH DISTRICT.

Aids to navigation, Mississippi River, La.—Work completed; for description see page 41.

Galveston Jetty Light Station, Tex.—The improved fog signal for which this special appropriation was made has been installed; for description see page 41.

Sabine Pass Jetty Light Station.—See Annual Report, 1920, page 49. The War Department completed extension of the jetties in 1920, and after allowing settlement, investigation of the site was made by the Lighthouse Service in 1921. Plans have been prepared and approved for an unwatched acetylene light and automatic fog bell operated by carbon-dioxide gas.

Sand Island Light Station, Ala.—See Annual Report, 1920, page 49. Bids for riprap were twice solicited and rejected, the first on account of excessive price, the second on account of unsatisfactory quality of material offered.

Keepers' dwellings.—A dwelling for keepers was completed at South Pass Range Rear Light Station; for description see page 41.

Repairing and rebuilding aids to navigation.—See Annual Reports for 1917–1921. During the past fiscal year work has been carried on under the several appropriations therefor as follows:

Appropriation, February 28, 1916, \$200,000, Galveston Depot, Tex.: Creosoted piles and untreated lumber, etc., purchased in the fiscal years 1919 and 1920; plans and specifications have been approved for the construction of the new depot wharf, and bids were invited for driving the piles. Only one bid was received, which was excessive. Steps are being taken to readvertise for more advantageous bids.

Appropriation, September 8, 1916, \$125,000, Pascagoula River East and West Bank Lights and Bayou Chamier Range Lights, etc., Miss.: Rebuilt 422 feet raised walk in marsh; also repaired 365 feet of walks to the structures.

Appropriation, March 28, 1918, \$100,000, St. Marks Light Station, Fla.: Rebuilt 325 feet wharf; rebuilt walks and made repairs to outbuildings and dwelling. Crooked River Range Light Station, Fla.: Repaired wharf and walks and outbuildings. Head of Passes Light Station, La.: Rebuilt 705 feet wharf; repaired outbuildings and oil house. Cubits Gap Light Station, La.: Rebuilt walks and outbuildings and repaired dwelling. Barataria Bay Light Station, La.: Rebuilt 712 feet wharf; repaired roof of dwelling and outbuildings. Bayou Rigolets Entrance Lights Nos. 1 and 3, Louisiana: Rebuilt single pile structures. Harvey Cutoff Entrance Lights Nos. 2 and 4, Louisiana: Rebuilt single pile structures. Bayou Villars Light and Fog Signal Station, La.: Repaired foundation struts of fog-signal tower, also lantern post.

Appropriation, March 6, 1920, \$125,000, allotment \$70,000, Matagorda Light Station, Tex.: Rebuilt 500 feet wharf, 700 feet walks, 720 feet fence, and repaired outbuildings, also foundations of dwellings.

Aransas Pass Light Station, Tex.: Rebuilt 100 feet wharf; outbuildings, oil house, cistern foundations, gallery steps, and made minor repairs to station.

The following work was in progress at the end of the fiscal year:

Turtle Cove Channel Lights Nos. 1, 3, 5, 7, 9, 11, 13, Texas: Material has been purchased, and working party is erecting seven lens lantern lights.

Corpus Christi Light, Tex.: Material has been purchased for erection of lens lantern light.

NINTH DISTRICT.

Aids to navigation, Guantanamo Bay, Cuba.—See Annual Report, 1921, page 47. The available balance of this appropriation will be used in purchasing additional lighting equipment.

Point Borinquen Light Station, P. R.—See Annual Report, 1921, page 46. The available balance of this appropriation will be used for a necessary roadway to this station.

Point Jiguero Light Station, P. R.—Work completed; for description see page 41.

TENTH DISTRICT.

Conneaut Harbor Light and Fog Signal Station, Ohio.—See Annual Report, 1921, page 52. During the past year one oil-engine air-compressor unit has been installed and the fog signal placed in commission. A duplicate engine and compressor will be installed this year.

Fairport Harbor, Ohio.—See Annual Report, 1921, page 52.

Huron Harbor, Ohio.—See Annual Report, 1920, page 93; arrangements are under way to install a fog bell, which will complete this project.

Light keepers' dwellings.—Seven thousand five hundred dollars was allotted this district for the purchase of a double dwelling for the keepers at Lorain, Ohio, which is now in progress.

ELEVENTH DISTRICT.

Detroit River, Mich.—See Annual Report, 1920, page 50. Congressional authority has been requested to use a portion of the balance of this appropriation for the construction of a patrol boat for this channel. Two additional lights will be established on concrete piers recently completed.

Aids to navigation, St. Marys River, Mich.—See Annual Report, 1921, page 52. At the close of the fiscal year work at Middle Neebish Cut, Pipe Island, and Frying Pan Island had been completed, also the reconstruction of the structures at Point of Woods Range and the front light of the Winter Point Range. The Winter Point Range Rear has been repaired, Johnsons Point Light foundation rebuilt, structures in West Neebish Channel repaired and rebuilt where necessary. Also Round Island has been converted to an unattended acetylene light, old stone piers at Lights 1 and 2, West Neebish Channel have been removed by dredging, and foundations for structures at Frechette Point and Six Mile Point Ranges have been rebuilt.

Spectacle Reef Light Station, Mich.—See Annual Reports, 1920 and 1921, pages 51 and 52, respectively. Appropriation July 1, 1918, \$28,000, and March 28, 1922, \$14,500. The drop in prices during the past year and additional tender service made it practicable to begin the extensive repairs needed to protect the foundation of this structure. The work has advanced to such a stage that it is expected to complete all repairs this season with the funds now available. The placing of the reinforced-concrete protective belt around the foundation has been completed on three sides, and work on the remaining side is under way.

Detroit Lighthouse Depot, Mich.—See Annual Reports, 1920 and 1921, pages 51 and 52, respectively. Appropriations, July 1, 1918, \$53,000, and March 28, 1922, \$50,000. Materials are on hand for completing the inner portion of the wharf, work on which will be started when the latter appropriation becomes available July 1. It is expected to complete the wharf during the present season.

TWELFTH DISTRICT.

Chicago Harbor Light Station, Ill.—See Annual Report, 1920, page 52.

Indiana Harbor, Ind.—See Annual Reports, 1920 and 1921, page 52. During the past fiscal year the reinforced-concrete basement was completed and work on the two-story brick and concrete light and fog-signal building was begun in May. All materials have been purchased, except the fog-signal machinery. It is expected to have the entire structure completed this season.

Calumet Harbor, Ill.—Appropriation March 28, 1922, \$66,000. This project involves the reconstruction of an old, inadequate, and unsafe building at the Calumet Harbor Light Station at outer end of the Calumet Breakwater and the replacement of obsolete and worn-out fog-signal machinery with modern electric motor-driven air compressor air diaphone and electric light in lens, also the installation of diaphone at Calumet North Pierhead. Preparation of plans is under way and work will be started this season.

Light keepers' dwellings.—The dwelling at Poverty Island Light Station has been completed; for description see page 41. Negotiations for a site for a dwelling at Manitowoc, Wis., are still under way.

SIXTEENTH DISTRICT.

Lighthouse Depot, Ketchikan, Alaska.—See Annual Report, 1921, page 52.

Aids to navigation, Alaska.—The acts of June 12, 1917, and June 19, 1919, appropriated \$60,000 and \$75,000, respectively, for establishing and improving aids to navigation in Alaskan waters. During the year 1922 1 gas buoy, 1 gas and whistling buoy, 1 gas and bell buoy, and 11 acetylene lights were established from the above appropriations. The appropriation on June 12, 1917, was entirely expended, and the amount expended from the appropriation of June 19, 1919, to June 30, 1922, is \$65,847.93. Data relative to these aids are shown in tabular form on the following page:

Name of light.	Locality.	Structure.	Illuminating apparatus.	Characteristic.	Intensity of light in candle-power.	Focal plane above mean high water in feet.	Miles seen.	Approximate cost.	Date of establishment.
Cape Wedge Light.	Shumagin Islands.	White house.	375-millimeter acetylene lantern.	Flashing white (flash 1 sec., eclipse 9 secs.).	310	60	11	\$2,631	July 11, 1921
East Amatuli Island Light.	Chugach Islands.	do.	do.	Flashing white (flash 3 secs., eclipse 27 secs.).	390	120	11	3,375	July 2, 1921
Three Hill Island Light.	Cross Sound.	do.	200-millimeter acetylene lantern.	Group flashing white: First flash, 0.5 sec., eclipse 1.5 secs., second flash 0.5 sec., eclipse 7.5 secs.	130	42	9	1,248	Sept. 28, 1921
Favorite Reef Light.	Stephens Passage.	White house on square pyramidal skeleton tower on concrete base.	do.	Flashing white (flash 1 sec., eclipse 9 secs.).	130	28	9	2,092	Sept. 30, 1921
Faust Rock gas and bell buoy, H. S.	do.	Red and black cylindrical skeleton superstructure.	do.	Flashing white (flash 0.3 sec., eclipse 2.7 secs.).	130	12	8	None. Fav- orite Reef gas and bell buoy used.	Do.
Egg Islands Light.	Coast between Cape St. Elias and Hinchinbrook.	White house.	do.	Flashing white (flash 0.6 sec., eclipse 5.4 secs.).	130	25	9	2,000	Nov. 22, 1921
Tee Harbor Light.	Stephens Pass.	White wooden house.	150-millimeter acetylene lantern.	do.	10	25	4	430	Mar. 4, 1922
Vanderbilt Reef Light.	Lynn Canal.	White wooden house on square skeleton tower on concrete base.	300-millimeter acetylene lantern.	Flashing white (flash 1.5 secs., eclipse 13.5 secs.).	230	36	10	3,430	Oct. 1, 1921
Point St. Albans Reef gas and whistling buoy, 1.	Sumner Strait.	Black; cylindrical; skeleton superstructure.	375-millimeter acetylene lantern.	Flashing white (flash 0.3 sec., eclipse 2.7 secs.).	390	16	9	6,984	Nov. 10, 1921
Snow Passage gas buoy, 2.	Clarence Strait.	Red; cylindrical; skeleton superstructure.	200-millimeter acetylene lantern.	Flashing red (flash 0.6 sec., eclipse 5.4 secs.).	40	12	.....	3,887	Oct. 19, 1921
Akutau Harbor Light.	Unimak Pass.	White wooden house.	do.	Flashing white (flash 0.6 sec., eclipse 5.4 secs.).	130	165	9	1,156	July 14, 1921
Point Craven Light.	Chatham Strait.	do.	150-millimeter acetylene lantern.	Flashing white (flash 1 sec., eclipse 9 secs.).	10	35	4	523	May 12, 1922
Port Alexander Light.	do.	do.	do.	Flashing white (flash 0.6 sec., eclipse 5.4 secs.).	10	55	4	523	May 11, 1922
Chatham Island Light.	Port Chatham.	do.	do.	Flashing white (flash 0.3 sec., eclipse 2.7 secs.).	10	40	4	875.16	June 29, 1922

SEVENTEENTH DISTRICT.

Aids to navigation, Coquille River, Oreg.—The act of July 1, 1916, appropriated \$6,000 for this project which contemplated the removal of the light and fog signal to the south side of the entrance. Navigators remonstrated against this proposed change but lately have requested the establishment of a fog bell at the seaward extremity of the South Jetty, and a project for its establishment has been approved. A project for the improvement of the present station buildings and grounds has also been approved recently. The failure of completion of the original object of the appropriation was on account of objection raised by navigators, and there has been insufficient time since the approval of the modified projects to carry out the work as now authorized. The necessary materials are now being purchased. It is expected that all work under this appropriation will be completed by December 31, 1922.

Aids to navigation, Washington and Oregon.—See Annual Report, 1921, page 53. One oil post light and one electric post light were established during the past fiscal year. Projects already approved will consume the unexpended balance of this appropriation during the next fiscal year.

Light keeper's dwelling, Yaquina Head, Oreg.—Appropriation, July 19, 1919; allotment, \$6,500. A modified bid in the amount of \$6,266 has been accepted for the construction of this dwelling, which will probably be completed by the end of December, 1922.

EIGHTEENTH DISTRICT.

Point Vincente, Calif.—See Annual Report, 1920, page 54. The site for this station has been acquired and bids were invited, for the construction of two dwellings for keepers and a fog-signal building, to be opened August 22, 1922.

SUMMARY OF IMPORTANT CONSTRUCTION AND REPAIR WORK UNDER GENERAL APPROPRIATIONS COMPLETED DURING FISCAL YEAR 1922.

FIRST DISTRICT.

Manana Island Fog Signal Station, repairs to tramway, \$2,639; tender *Zizania*, docking and repairs, \$3,880.

SECOND DISTRICT.

Chelsea Lighthouse Depot, moving keeper's dwelling and remodeling, \$5,593. Vessels, docking, and repairs: Tender *Anemone*, \$3,359; tender *Mayflower*, \$14,812; tender *Azalea*, \$3,418; light vessel No. 47, \$1,056; light vessel No. 73, \$1,789; light vessel No. 86, \$2,904; light vessel No. 90, \$1,398.

THIRD DISTRICT.

Execution Rocks Light Station, general repairs, installing oil tanks and apparatus for fog-signal tests, \$2,289; Falkner Island Light Station, repairs to dwelling, \$1,293; Fort Adams Light, installing gas light on steel tower, \$5,619; Horton Point Light Station, repairs to dwelling, \$3,157; Hudson River Lights, concrete foundations for steel towers and establishing fog bell at Jeffreys Hook, \$10,516; Long Beach Bar Light Station, concrete foundation and general repairs, \$5,742; Noank Light, establishing light, \$1,932; Penfield Reef Light Station, general repairs and installing boat crane, \$2,423; New London Ledge Light Station, installing oil tanks and general repairs, \$1,927; Prudence Island Light Station, changing light from fixed to flashing and repairs to fog signal, \$1,796; Sakonnet Light Station, new gallery roof and other repairs, \$3,536; Stepping Stones Light Station, installing toilet and general repairs, \$1,082. Vessels, docking, repairs, etc.: Tender *Pansy*, \$1,189; tender *Larkspur*, \$1,374; tender *Tulip*, \$4,647; light vessel No. 87, \$4,570; light vessel No. 39, \$3,472; light vessel No. 68, \$3,906; light vessel No. 79, \$5,376; light vessel No. 79, changing light from oil to acetylene, \$3,899; light vessel No. 16, \$1,503; light vessel No. 78, installing radio fog signal, \$2,161; light vessel No. 11, \$2,183.

FOURTH DISTRICT.

Cape May Light Station, new heating plant and general repairs, \$1,698; Finns Point Range Rear Light Station, general repairs, \$1,587; Eagle Point Range Lights, wooden posts replaced with steel towers, \$5,556; Christiana North Jetty Light, changed from oil to acetylene, \$1,001; Bordentown Range Lights, rearrangements of lights, new

range established on Duck Island, \$2,777; Trenton Range Lights, lights moved and changed from oil to acetylene, \$1,791; Lewes Lighthouse Depot, new boat provided, \$2,404; Murderkill River Range Lights, new structures and illuminating apparatus provided, \$2,784; St. Jones River Range Lights, changed from oil to acetylene, \$1,352; Leipsic River Range Lights, changed to acetylene, \$1,728; Edgemoor Depot, fender piles renewed, \$1,861; tender *Woodbine*, docking and repairs, \$3,914.

FIFTH DISTRICT.

Croatan Light Station, additional pile dolphins, \$1,582; Fishing Battery Light, establish light on skeleton tower, \$1,545; Fort Macon and Bird Island Range Lights, establishment of Fort Macon and relocation of Bird Island Range Lights, \$1,185; Goose Hill Channel Range Front Light, changed to acetylene, \$1,022; Lazaretto Depot, general repairs to wharf, areaway, and buildings, \$3,899; Portsmouth Depot, repairs to wharf, \$5,460; Portsmouth Depot Coal Barge, docking and repairs, \$2,446. Vessels, docking, and repairs: Light vessel No. 72, \$2,797; light vessel No. 52, \$2,086; Relief Light Vessel No. 49, \$4,618; light vessel No. 91, \$1,471; tender *Maple*, \$4,708; tender *Juniper*, \$1,056; tender *Orchid*, \$9,743.

SIXTH DISTRICT.

Vessels, docking, and repairs: Tender *Cypress*, \$19,749; tender *Mangrove*, \$4,346; tender *Palmetto*, \$2,998; tender *Water Lily*, \$3,574; Relief Light Vessel No. 53, \$2,100; light vessel No. 84, \$4,357; light vessel No. 94, \$2,915; light vessel No. 1, \$3,207.

SEVENTH DISTRICT.

Key West Light Station, construction of sidewalks and retaining walls and general repairs, \$3,384; Cedar Keys, establish 2 acetylene lights and 23 single pile beacons, \$2,593; Seahorse Reef Light, provide new iron superstructure and acetylene light, \$3,813; Miami Harbor and Biscayne Bay, construct three 5-pile dolphin lights, two 5-pile dolphin beacons and 21 single pile beacons, \$886; tender *Ivy*, docking and repairs, \$3,722.

EIGHTH DISTRICT.

Cat Island Shoal Gas Buoy, established, \$1,800; Crooked River Range Light Station, repairs to wharf, \$1,996; Cubits Gap Light Station, moving tower and dwelling, \$1,501; Galveston Gas and Bell Buoy, replacing gas buoy with gas and bell buoy, \$4,025; Lake Borgne Light Station, placing rock protection, \$1,238; St. Marks Light Station, rebuilding wharf and repairing outbuildings, \$2,223; Sabine Pass Channel Gas Buoys, establishing two gas buoys, \$3,600; Sand Island Light Station, painting tower, \$1,021; South Pass Range Rear Light Station, scaling and painting tower, \$1,190; vessels docking and repairs, light vessel No. 81, \$3,362; tender *Magnolia*, \$32,322; tender *Sunflower*, \$5,568. West Bank Gas and Bell Buoy, establishing, \$4,025.

NINTH DISTRICT.

Buck Island Light Station, changed from oil to acetylene, \$1,000; San Juan Depot, repairs to buoy, cleaning shed and blacksmith shop, \$1,489; Cardona Island Light Station, changed from oil to acetylene, \$1,025; Mona Island Light Station, repairing hurricane damage, \$4,375; Point Tuna Light Station, general repairs, \$1,400; tender *Lilac*, general repairs, \$2,005.

TENTH DISTRICT.

Green Island Light Station, rebuilding superstructure of wharf, \$1,843; Dunkirk Light Station, rebuilding barn destroyed by fire, \$1,757; Lorain West Pier Light, removing old wooden tower, erecting steel tower, and installing electric light, \$1,493; tug *Birch* new boiler \$2,227; tender *Crocus*, general repairs, \$5,267.

ELEVENTH DISTRICT.

Tawas Light Station, moving dwelling from Ecorse Light Station, remodeling same, building walks and retaining walls, \$9,121; Detour Submarine Signal, renew electric cable, \$1,180; Marquette Light Station, installing electrically driven air compressor, \$2,406; Two Harbors Light Station, replacing old fog signal with diaphone,

and providing water supply from well, \$8,755; Ashland Breakwater Light Station, repairs and alterations to boat landing, \$1,424; Rouleau Point and Portage Lake Ship Canals Ranges, four lights changed from oil to acetylene, and two steel towers erected, \$3,850; tender *Aspen*, general repairs, \$5,079; tender *Marigold*, installing refrigerating plant and repairs, \$1,922.

TWELFTH DISTRICT.

Point Betsie Light Station, replacing old fog signal with diaphone and electrically operated air compressor, installing electric lights, and general repairs, \$9,820; Poverty Island Light Station, replacing steam fog signal with diaphone and repairing dwelling, \$13,424; Milwaukee Depot, portable air compressor and improvements to warehouse, \$2,670. Vessels, docking, repairs, and improvements: Tender *Hyacinth*, \$2,724; tender *Sumac*, \$6,914; light vessel No. 95, \$2,035; light vessel No. 98, \$1,337; light vessel, No. 60, \$3,229. Gas buoys, modifying eight oil gas buoys to acetylene, \$5,192.

THIRTEENTH DISTRICT.

Tender *Dandelion*, docking and repairs, \$6,682.

FIFTEENTH DISTRICT.

Tender *Oleander*, repairs, \$1,370.

SIXTEENTH DISTRICT.

Mary Island Light Station, repairing tramway and station, \$2,242; Eldred Rock Light Station, repairing tramway, \$1,584; cargo boat for tender *Cedar*, providing new boat, \$1,964; tender *Cedar*, docking and repairs, \$3,326; tender *Fern*, docking and repairs, \$2,907.

SEVENTEENTH DISTRICT.

Cape Arago Light Station, installing water system and constructing elevated walk and bridge, \$9,176; Willapa Bay Light Station, installing sanitary and water system, constructing roadway, and general repairs, \$5,765; Cape Meares Light Station, constructing new trail 1½ miles long from station to town of Bayocean, \$4,165. Vessels, docking and repairs: Tender *Manzanita*, \$1,072; light vessel No. 88, \$1,474; light vessel, No. 92, \$3,230.

EIGHTEENTH DISTRICT.

Goat Island Depot, building retaining wall, mooring dolphins, and filling in around dock, \$8,785; Carquinez Strait Light Station, installing concrete protection for foundation piles, \$6,749; Humboldt Bay Fog Signal, repairing buoy wharf, \$2,322; Point Arena Light Station, installing new water tank, \$1,454. Vessels docking and repairs: Tender *Sequoia*, \$6,980; tender *Madrono*, \$9,696; light vessel No. 76, \$3,712; light vessel No. 70, \$1,484; light vessel No. 70, installing radio fog signal, \$3,193.

NINETEENTH DISTRICT.

Makapuu Point Light Station, repairing 5 miles of station road, \$3,089; Pauwela Point Light Station, installing new tower and acetylene light, \$2,037; Makahuena Point Light Station, installing acetylene light on concrete tower, \$2,498; Kailua Light Station, installing acetylene light on concrete tower, \$2,033; Napoopoo Light Station, installing acetylene light on concrete tower, \$2,179; tender *Kukui*, docking and repairs, \$3,299.

UNEXPENDED BALANCES ON JUNE 30, 1922, FROM APPROPRIATIONS FOR SPECIAL WORKS.

District.	Title of appropriation.	Acts.	Balance.
General..	Repairing and rebuilding aids to navigation, Atlantic coast.	Mar. 28, 1918; Nov. 4, 1918...	\$41,753.85
	Light vessels for general service.....	Aug. 24, 1912; Aug. 26, 1912..	97,302.97
	Radio installations on lighthouse tenders.....	June 12, 1917.....	13,894.91
	Repairing and rebuilding aids to navigation, seventh and eighth lighthouse districts.	Mar. 6, 1920.....	34,058.37
	Vessels for Lighthouse Service.....	Nov. 4, 1919; Mar. 4, 1921....	825,467.75
	Lightkeepers' dwellings.....	July 19, 1919.....	23,877.28
2d.....	Nantucket Harbor Fog Signal, Mass.....	Mar. 28, 1918.....	2,928.43
3d.....	Aids to navigation, Hudson River, N. Y.....	July 1, 1916.....	942.70
	Tender for third lighthouse district.....	June 12, 1917.....	149,456.96
	Great Salt Pond Light Station, R. I.....	do.....	1,296.95
	Staten Island Lighthouse Depot, N. Y. (machine shop).	July 19, 1919.....	29,995.34
	Riprap protection for light station, third lighthouse district.	do.....	68,451.58
	Aids to navigation, Raritan Bay and connected waters.	Mar. 28, 1922.....	100,000.00
4th.....	Aids to navigation, Delaware Bay Entrance.....	do.....	138,000.00
5th.....	Cape Charles Light Vessel, Va.....	June 12, 1917.....	129,900.38
	Aids to navigation, Chesapeake Bay, Md. and Va.	do.....	18,598.41
	Fifth lighthouse district gas buoys.....	July 1, 1918; Nov. 4, 1918....	4,602.80
	Diamond Shoal Light Vessel, N. C.....	Nov. 4, 1919.....	23,167.86
6th.....	Aids to navigation, St. Johns River, Fla.....	July 1, 1916.....	12,461.84
7th.....	Aids to navigation, Florida Reefs, Fla.....	do.....	2,472.69
	Aids to navigation, Florida coast, Fla.....	Mar. 28, 1922.....	50,000.00
	Repairing and rebuilding aids to navigation, seventh lighthouse district.	Mar. 20, 1922.....	59,961.04
8th.....	Galveston Jetty Light Station, Tex.....	June 11, 1896; May 27, 1908; Mar. 4, 1921.	1,277.98
	Sabine Pass Jetty Light Station, Tex.....	May 27, 1908.....	40,000.00
	Southwest Pass Light Vessel, Mississippi River...	Oct. 22, 1913.....	882.85
	Repairing and rebuilding aids to navigation, Gulf of Mexico.	Feb. 28, 1916; Sept. 8, 1916; Mar. 28, 1918.	17,823.41
	Aids to navigation, Mississippi River, La.....	July 1, 1916.....	518.14
	Tender and barge for eighth lighthouse district.....	do.....	90.88
	Sand Island Light Station, Ala.....	July 1, 1918.....	36,631.43
9th.....	Aids to navigation, Guantanamo Bay, Cuba.....	do.....	1,057.90
	Point Borinquen Light Station, P. R.....	June 12, 1917.....	14,471.99
	Point Jiguero Light Station, P. R.....	July 19, 1919.....	578.78
	San Juan Lighthouse Depot, P. R.....	Mar. 28, 1922.....	60,000.00
10th.....	Aids to navigation, Ashtabula Harbor, Ohio.....	Oct. 22, 1913.....	2,054.97
	Aids to navigation, Conneaut Harbor, Ohio.....	July 1, 1916; Nov. 4, 1919; Mar. 1, 1921.	5,909.16
	Aids to navigation, Huron Harbor, Ohio.....	June 12, 1917.....	407.58
	Aids to navigation, Fairport Harbor, Ohio.....	do.....	52.75
11th.....	Detroit River Lights, Mich.....	Mar. 4, 1911.....	49,323.68
	Aids to navigation, Fighting Island Channel, Detroit River, Mich.	July 1, 1916.....	83.85
	Aids to navigation, Keweenaw Waterway, Mich...	June 12, 1917.....	125.30
	Detroit Lighthouse Depot, Mich.....	July 1, 1918; Mar. 28, 1922....	50,115.75
	Spectacle Reef Light Station, Mich.....	do.....	21,403.06
	Aids to navigation, St. Marys River, Mich.....	Nov. 4, 1918.....	1,348.11
12th.....	Chicago Harbor Light Station, Ill.....	June 12, 1917; July 19, 1919..	2,921.15
	Aids to navigation, Indiana Harbor, Ind.....	June 12, 1917.....	24,498.06
	Aids to navigation, Calumet Harbor, Ill.....	Mar. 28, 1922.....	66,000.00
16th.....	Aids to navigation, Alaska.....	July 19, 1919; Mar. 28, 1922....	142,042.68
	Depot for sixteenth lighthouse district.....	July 1, 1918; Mar. 6, 1920....	341.42
17th.....	Aids to navigation, Coquille River, Oreg.....	July 1, 1916.....	5,959.66
	Aids to navigation, Washington and Oregon.....	June 12, 1917.....	194.35
18th.....	Point Vincente Light Station, Calif.....	July 1, 1916.....	65,936.50
19th.....	Aids to navigation, Pearl Harbor, Hawaii.....	June 12, 1917.....	3,859.95

APPROPRIATIONS CARRIED TO SURPLUS FUND.

The following balances of appropriations for special works in the Lighthouse Service, the objects of which had been accomplished, were covered into the surplus fund in the Treasury, June 30, 1922:

Light vessels for general lake service.....	\$629.78
Depot for second lighthouse district.....	32.42
Staten Island Lighthouse Depot, N. Y. (wharves).....	1,336.35
Staten Island Lighthouse Depot, N. Y. (office and laboratory).....	239.33
Execution Rocks Light Station, N. Y.....	42.02
Joe Flogger Shoal Light Station, Delaware River.....	51.62
Southwest Pass Light Vessel, Mississippi River.....	11,000.00
Aids to navigation, Atchafalaya Entrance Channel, La.....	19.56
Aids to navigation, Toledo Harbor, Ohio.....	211.92
Sand Hills Light Station, Mich.....	5.07
White Shoal Light Station, Mich.....	21,186.23

ASSISTANCE RENDERED IN SAVING LIFE AND PROPERTY BY VESSELS OR EMPLOYEES OF THE LIGHTHOUSE SERVICE DURING THE FISCAL YEAR 1922.

The following extracts from reports received by the bureau give some typical cases of especially meritorious service rendered by vessels and employees of the Lighthouse Service in saving life and property during the fiscal year:

Wrecked motor boat.—On June 25, 1922, Daniel F. McCoart, keeper of Bridgeport Harbor Light Station, Conn., rescued the occupants of a motor boat which had struck a submerged foundation, tearing a hole in the bottom. The keeper stated: "Aboard at the time were three men and a boy. I heard their cries for help and lowered the boat and went to their assistance, taking off the boy and instructing the men to keep signaling to a motor boat, which later towed them into the lighthouse basin. I furnished them with materials and tools for making necessary emergency repairs."

Rescue of boy.—On May 25, 1922, James F. Kelly, a seaman on the lighthouse tender *Orchid*, jumped overboard and rescued a newspaper boy, 9 years of age, who had fallen overboard at the Portsmouth Lighthouse Depot. The prompt action of Seaman Kelly saved the boy from drowning, as he was nearly exhausted when rescued.

Freight vessel aground.—On May 29, 1922, the lighthouse tender *Juniper*, J. M. Kendley master, was proceeding to Portsmouth, Va., from duty in the Sounds of North Carolina, and upon arriving at Pungo Ferry, North Landing River, at about 6 p. m., found the seagoing vessel *W. A. McIntosh* aground just north of Pungo Ferry. The *Juniper* made fast, and after working for about 45 minutes succeeded in pulling the *McIntosh* into deep water.

Motor boat in distress.—On January 4, 1922, E. J. Whidden, second assistant keeper, Carysfort Reef Light Station, Fla., rescued the motor boat *Napinee* in the face of a strong southeast wind, just as the vessel was drifting in on one of the Florida Reefs. The boat had been adrift two days, owing to engine trouble. The four occupants, who were practically exhausted from exposure, rough weather, and lack of food, were given food and dry clothing at the light station.

Aid to wounded man.—On June 13, 1922, a man was brought to Muertos Island Light Station, P. R., in an unconscious condition and suffering from a serious wound in the arm. Alfonso Sanchez Bermudez, keeper of the station, rendered first-aid treatment. In reporting the matter the keeper stated: "At 5 p. m. on this date a man by the name of Juan Cruz was brought to the station, being unconscious. He had a 3½-inch wound in his left forearm so deep that it cut through tendons, veins, and tissues, causing a great hemorrhage. The undersigned furnished him first aid, it being necessary to stitch up the wound in order to stop bleeding, and take him immediately to Ponce, where he could have medical attention."

Drowning.—On June 14, 1921, Charles L. Abney, lamplighter, Rock River Light, upper Mississippi River, tried to save two children from drowning at the lower entrance to Lock 32, Illinois and Mississippi Canal. There were three children in wading; they got beyond their depth; and in attempting to rescue the children, two of whom were drowned, Mr. Abney heroically lost his life.

Capsized United States Army transport.—The United States Army quartermaster transport *V-10*, leaving Honolulu under tow on June 22, 1922, capsized and sank in 33 feet of water alongside the dock. A large part of the vessel's cargo, which was afloat, was salvaged by the lighthouse tender *Kukui*, Capt. Ole Eriksen, commanding, and on June 24, with a diver from Pearl Harbor Naval Station, the *Kukui* raised the transport with skill and judgment.

A complete list in condensed form of cases of assistance rendered in the saving of life and property by employees and vessels of the Lighthouse Service during the fiscal year, arranged in the order of lighthouse districts, follows.

FIRST DISTRICT.

Portland Light Vessel No. 74, Maine, Adelbert J. Kent commanding, furnished board and lodging to two men, whose power boat was disabled, until they could be taken ashore; also on another occasion loaned gasoline and oil to a power boat to enable her to make port.

C. H. Newman, keeper, Pumpkin Island Light Station, Me., went to the assistance of two ladies and two children who were adrift in a rowboat.

E. W. Lovatt, first assistant keeper, Ram Island Ledge Light Station, Me., picked up a launch which was adrift, towed it to the light station, and with help of John B. Dewyea, keeper, delivered the launch to the owner.

J. B. Dewyea, keeper, Ram Island Ledge Light Station, Me., piloted to port two men who had got lost in the fog without a boat compass.

A. P. N. Tribou, assistant keeper, Rockland Breakwater Light Station, Me., assisted the owner in saving a large cabin cruiser which had run aground on the ledges.

W. H. Marr, keeper, Hendricks Head Light Station, Me., towed a disabled motor boat to safe anchorage.

Elmer Reed, keeper, Negro Island Light Station, Me., picked up a boat which was adrift and returned it to owner.

W. A. Stetson, keeper, Burnt Island Light Station, Me., assisted in floating a disabled motor boat which had drifted ashore, towed the boat to a safe anchorage, and assisted in repairs to the same.

SECOND DISTRICT.

Henry L. Thomas, keeper, and Albert S. Smith, assistant keeper, Cape Poge Light Station, Mass., assisted in floating the large sloop-yacht *Ladrone*, of New York, that had run aground off the reservation. They also assisted in floating the yacht *Dolly*, of Boston, which had run aground on a ledge, and transferred five passengers from the yacht to Edgartown, Mass., in the station motor boat.

Pollock Rip Slue Light Vessel No. 73, Massachusetts, Simeon C. Studley, jr., commanding, rescued a man who was in an exhausted condition and who had been three days adrift in a dory from the schooner *Elizabeth Ruth*. The man was furnished food and the dory was repaired.

J. E. Rogers, keeper, Dumpling Rock Light Station, Mass., assisted in pulling off the rocks, on the southwest side of the light, the disabled power boat *Kyra* with five men on board and in anchoring it in safe water.

Arthur L. Payne, keeper, and Charles A. Lyman, assistant keeper, Bakers Island Light Station, Mass., towed the disabled motor launch *Brother Bill*, of Boston, with three men and a boy on board, to Marblehead, Mass.

Arthur A. Small, keeper, Narrows Light Station, Mass., rescued three fishermen whose boat had become disabled and who were benumbed by ice and cold, secured the boat with a kedge anchor, and furnished the men with food, lodging, and dry clothing.

The tender *Anemone*, Elbert W. Bartow commanding, towed the tug *Augustus*, whose boilers were out of commission, from Buzzards Bay to New Bedford, Mass.

F. K. Schlamp, quartermaster, tender *Azalea*, by his vigilance discovered a fire in a carpenter shop near the dock and promptly called the fire department.

Charles W. Vanderhoop, keeper, and Solomon M. Attaquin, assistant keeper, Gay Head Light Station, Mass., assisted in extinguishing a fire in a dwelling in the vicinity of the light station.

The tender *Mayflower*, Aquilla P. Bartow commanding, towed the disabled auxiliary sloop *Lark* No. D-571, with two men on board, $3\frac{1}{2}$ miles to Gloucester, Mass.

THIRD DISTRICT.

William Hardwick, keeper, Bridgeport Harbor Light Station, Conn., towed a disabled cabin cruiser, having a party of men and women aboard, to the yacht club in Bridgeport.

Dominick DeSiena, keeper, Walter J. Ross, first assistant keeper, and George W. Denton, second assistant keeper, New Haven Light Station, Conn., rendered assistance to the occupants of a boat caught in a squall off the New Haven Breakwater and furnished them food and lodging at the station.

Daniel F. McCoart, keeper, West Bank Light Station, N. Y., furnished food and lodging to two men in a canoe who had lost their way and landed at the station.

A. R. Andersen, keeper, West Point Light Station, N. Y., went to the assistance of two small boys in a rowboat drifting down the Hudson River without oars. The boat, which was partly filled with water, was towed to shore.

Eugene H. Merry, keeper, Little Gull Island Light Station, N. Y., rendered assistance to the occupants of two rowboats which were adrift and towed them to Fort Michie.

Stephen Holm, keeper, Stepping Stones Light Station, N. Y., rescued two men whose canoe had capsized and landed the men and the canoe in City Island, N. Y.

Eugene H. Merry, keeper, Little Gull Island Light Station, N. Y., went to the assistance of the launch *Grace* with two men aboard, which was lost in fog, piloted the launch to the station, and furnished the men with food and shelter.

Albert Wilkinson, keeper, and J. E. Dudley, second assistant keeper, Southwest Ledge Light Station, Conn., rescued a man, woman, and little girl who were thrown into the water from a rowboat.

The tender *Mistletoe*, Walter G. Loring commanding, went to the assistance of the yacht *Harpoon*, there being an explosion on board and the yacht on fire. Although the *Mistletoe* was loaded with oil, etc., she succeeded in putting out the fire.

William Hardwick, keeper, Bridgeport Harbor Light Station, Conn., assisted the launch *Clara H*, which had gone ashore on the west breakwater, furnished lodging at the station to the occupant of the launch, and towed him ashore.

Henry R. McCarthy, keeper, J. A. Burk, additional keeper, and W. G. Gaird, a workman, Stratford Shoal Light Station, Conn., went to the assistance of the disabled power boat *Glatys*, and furnished medicine, clothing, food, and lodging at the station to the crew of four men, who were in a sick and enfeebled condition from exposure, having been adrift 18 hours.

The tender *Mistletoe*, Walter G. Loring commanding, went to the assistance of the tugboat *Solicitor*, of Newport, R. I., which had a lighter in tow loaded with gravel. The *Mistletoe* towed the lighter ashore into a sheltered position, after which it was again taken in charge by the tug *Solicitor*.

James H. Bently, keeper, Romer Shoal Light Station, N. Y., rendered assistance to a disabled motor boat, furnished the two occupants with food and lodging, provided repairs for boat, and aided them ashore.

The tender *Pansy*, Walter G. Loring commanding, assisted the disabled tugboat *Frederick T. Kellers*, of New York: part of feedwater heater on tugboat having burst and a man seriously injured. The tender took the injured man aboard, applied first aid, and then proceeded to New London Lighthouse Depot and had the injured man taken to the hospital.

A. P. Andersen, keeper, West Point Light Station, N. Y., rescued a man from an overturned canoe in Hudson River, took him to shore, and later recovered the canoe.

Daniel F. McCoart, keeper, Bridgeport Harbor Light Station, rescued the occupants of a motor boat, which had struck a submerged foundation tearing a hole in its bottom.

William Shackelton, first assistant keeper, and John R. Bishop, second assistant keeper, West Bank Light Station, N. Y., picked up two men who were drifting in a small power boat in a rough sea, and furnished lodging overnight at the light station to the men.

Charles J. Kenny, keeper, George H. Barker, first assistant keeper, and George H. Clarke, second assistant keeper, Pecks Ledge Light Station, Conn., rescued four men who were drifting in a small boat from the sunken steamer *J. C. Austin*, of Brooklyn, and who were suffering severely from exposure. They were taken to the light station and given first aid medical attention as well as clothing, food, and lodging, and were later taken ashore to a hospital by an oyster steamer.

James B. Murdock, keeper, Rondout Light Station, N. Y., rescued a man who had slipped off the dike into the icy creek, furnished him clothing, and hurried him ashore for medical treatment.

Charles Redfern, keeper, Point Comfort Light Station, N. J., assisted the master and his son in the case of three barges which were driven ashore and sunk in a gale.

James H. Bentley, keeper Romer Shoal Light Station, N. Y., assisted John Rogan, 54 Stratford Road, Brooklyn, N. Y., who was in exhausted condition in a rowboat, took him to the station, and gave him dry clothing and lodging for the night.

Fred Hainsworth, keeper, West Bank Light Station, N. Y., went to the assistance of a power boat which was in a sinking condition, with three men aboard, and towed it to a passing tug.

The tender *Tulip*, Capt. Henry Q. Austin commanding, rendered assistance to two scows which were on fire in the East River, and had fire under control when a fire-boat arrived.

R. G. Hendrick, keeper, Fitchs Point, Norwalk Harbor Lights, Conn., rescued two men from Goose Island whose boat had swamped and who were suffering from exposure.

FOURTH DISTRICT.

George A. Holston, skilled laborer, Lewes Lighthouse Depot, Del., towed a disabled naval launch to shore, repaired the engine, and recovered all the equipment, which had floated out of the launch.

FIFTH DISTRICT.

Arthur Midgett, keeper, and R. P. Fulcher, assistant keeper, Harbor Island Bar Light Station, N. C., towed the disabled gas boat *Thomas Ward* into harbor.

The tender *Juniper*, J. M. Kendley commanding, towed the disabled power boat *Edna May* to port.

Gary E. Powell, keeper, Fort Washington Light Station, Md., assisted in floating the gas boat *Lillian* which had run onto submerged piling in the vicinity of Fort Washington.

Jesse M. W. Shockley, keeper, Sharps Island Light Station, Md., towed to Cooks Point the hydroplane *Lady Baltimore*, with two occupants, which was sighted adrift about 1 mile from station.

William J. Tate, keeper, North Landing River, etc., Lights, N. C., floated two subchasers which had run ashore in vicinity of Long Point, N. C.

Steve Fuchs, quartermaster, tender *Juniper*, rescued a mess attendant from the same vessel who had become exhausted from swimming.

The tender *Juniper*, J. M. Kendley commanding, assisted in fighting a water-front fire at the wharves of Smithfield, Va.

J. E. English, keeper, Thomas Point Shoal Light Station, Md., assisted the disabled motor boat *Floribel*, with two men aboard, and secured aid to tow it ashore.

B. D. Preston, first assistant keeper, and H. L. Matthews, second assistant keeper, Wolf Trap Light Station, rendered assistance to a disabled seaplane with two occupants.

Edward Linton, assistant keeper, Baltimore Light Station, Md., rendered assistance and furnished food to six men who had been adrift in a yacht.

W. B. Clifton, keeper, Roanoke River Light Station, N. C., repaired the engine of a launch which had become disabled near that station.

Gary E. Powell, keeper, Fort Washington Light Station, Md., went to assistance of gas boat which had run ashore.

The tender *Maple*, Thomas J. Miles commanding, towed to Baltimore Light Station, Md., the schooner *Catherine* which was icebound off Seven Foot Knoll; also towed the steamer *Avalon* from Seven Foot Knoll to Fort Carroll, Md.

H. Almy, jr., port captain, H. W. Partin, blacksmith, and William Villiers, general helper, Portsmouth Depot, Va., rendered assistance at a fire in Berkley Ward, Norfolk, Va.; the master and crew of the tender *Juniper* also assisted at this fire.

The tender *Juniper*, J. M. Kendley commanding, assisted the fishing vessel *W. A. McIntosh*, which had run aground in North Landing River, N. C., towing her into deep water.

The tender *Maple*, Thomas J. Miles commanding, assisted in floating the Bureau of Fisheries steamer *Fish Hawk*, which was aground in the Potomac River.

Light vessel No. 101, T. S. Simons commanding, rescued six men adrift in a launch during a heavy gale who were without food, water, and fuel.

J. T. Twiford, keeper, and C. P. Morgan, assistant keeper, Thimble Shoal Light Station, rescued two members of the crew of a steamer which had sunk, furnishing them dry clothing, food, and shelter for the night.

Charles A. Sterling, keeper, Craney Island Light Station, rendered assistance to the gasoline boat *Loretto* with 13 passengers aboard which had become disabled and drifted before a strong wind.

James F. Kelly, seaman, tender *Orchid*, rescued a newspaper boy who had fallen overboard at the Portsmouth Lighthouse Depot.

SIXTH DISTRICT.

The tender *Cypress*, John P. Johnson, commanding, rendered valuable assistance at a fire at Columbus Street Wharf, Charleston, S. C.

The tender *Mangrove*, E. C. Tull commanding, extinguished a fire on a launch of the U. S. S. *Dixie*.

Thomas Knight, keeper, Guthrie Phelps, first assistant keeper, Hillsboro Inlet Light Station, Fla., and the keeper's sons, went to the assistance of a small motor boat which had been swamped on the bar, rescued the three occupants of the boat, furnished them food and dry clothing, and towed the motor boat to land.

The tender *Cypress*, Capt. J. P. Johnson commanding, went to the assistance of the steamship *J. E. O'Neil*, of the Atlantic Refining Co., aground on the outer bar of St. Simon Sound, Ga.

The tender *Palmetto*, Emil F. Redell commanding, rendered assistance to the schooner *Phoebe Crosby*, aground at the entrance to Winyah Bay, S. C., and transported the captain of the schooner and seven of the crew to Georgetown Light Station.

Joseph Grissillo, keeper, Georgetown Light Station, S. C., furnished shelter to the crew of the wrecked schooner *Phoebe Crosby*.

Richard Stonebridge, keeper, Daufuskie Island Light Station, S. C., rendered assistance to two occupants of a disabled launch, and furnished them dry clothing, food, and shelter for the night.

Thomas Knight, keeper, Hillsboro Inlet Light Station, Fla., and his son, went to the assistance of the Norwegian steamship *Tancrede*, which was aground about 10 miles north of the light station.

Thomas Knight, keeper, Guthrie Phelps, first assistant keeper, Hillsboro Inlet Light Station, Fla., and two sons of the keeper, rendered assistance to the steamship *H. C. Folger*, aground about 5 miles south of the light station.

C. P. Honeywell, keeper, Cape Canaveral Light Station, Fla., arranged for the delivery of 300 gallons of oil to the yacht *Centaur*, which came into Canaveral Bight short of oil.

SEVENTH DISTRICT.

On January 4, 1922, E. J. Whidden, second assistant keeper, Carysfort Reef Light Station, rescued the disabled motor yacht *Napinee* in the face of a strong southeast wind just as the vessel was drifting in on one of the Florida reefs. The four occupants, who were practically exhausted from exposure, rough weather, and hunger, were furnished food and dry clothing by C. F. Fine, first assistant keeper, and the second assistant keeper, Mr. Whidden, and given shelter at the light station while the keepers repaired the engine of the yacht.

EIGHTH DISTRICT.

G. R. Smith, keeper, and L. R. Smith, assistant keeper, Red Fish Bar Cut Light Station, Tex., went to the assistance of two men in a launch which had grounded in vicinity of station.

T. Hansen, keeper, and U. M. Gunn, assistant keeper, Crooked River Range Light Station, Fla., went to assistance of two men in a launch which had become disabled in vicinity of station during a heavy southwest squall.

Fred Shuman, keeper, Gulfport Channel Lights, Miss., towed a disabled trawlboat with two men aboard to a place of safety.

A. E. Steiner, keeper, and W. J. Laughlin, assistant keeper, Horn Island Light Station, Miss., went to the assistance of a schooner which had run ashore in the vicinity of station.

Harry Brouwer, keeper, and D. C. Powell, assistant keeper, Round Island Light Station, Miss., went to the assistance of a disabled launch, with 10 persons aboard, which was adrift in the vicinity of station, and assisted in making temporary repairs to the engine.

G. R. Smith, keeper, and L. R. Smith, assistant keeper, Red Fish Bar Cut Light Station, Tex., went to the assistance of five persons who had taken refuge on a shell dump in the vicinity of the station, after their launch had sunk, and assisted in re-floating the launch.

J. D. Balsillie, keeper, and A. C. Marquardt, assistant keeper, Galveston Harbor Lights and Fog Signal Station, Tex., towed a disabled sloop, which had lost her rudder, to a place of safety.

W. H. Heinroth, keeper, Matagorda Light Station, Tex., assisted in floating a disabled tug, which had grounded about 5 miles from the light station, and towed it to a place of safety.

Fred Shuman, keeper, and John Lettich, assistant keeper, Gulfport Channel Lights, Miss., went to the assistance of a trawlboat which had become disabled in a collision with a buoy.

Charles Bateman, keeper, Cat Island Light Station, Miss., assisted in floating a yacht whose engines had become disabled and which had grounded on a shoal in the vicinity of the light station.

Fred Shuman, keeper, and John Lettich, assistant keeper, Gulfport Channel Lights, Miss., assisted in searching for a motor launch and a skiff, which were lost in Mississippi Sound.

W. H. Heinroth, keeper, Matagorda Light Station, Tex., assisted in floating a launch which had run aground in the vicinity of the station.

G. W. Anderson, keeper, Halfmoon Reef Light Station, Tex., went to assistance of fishermen adrift in an open boat 2 miles from shore.

J. D. Balsillie, keeper, and A. C. Marquardt, assistant keeper, Galveston Harbor Lights and Fog Signal Station, Tex., towed a United States Coast Guard launch, which had grounded in Galveston Bay, to the Coast Guard station.

J. E. Ewing, second officer, tender *Cosmos*, went to the assistance of the motor boat *Day Light*, with four persons aboard, in Lake Borgne 4 miles off the entrance to Bayou Du Pre, and furnished necessary fuel and provisions.

NINTH DISTRICT.

Alfonso Sanchez Bermudez, keeper, Muertos Island Light Station, P. R., rendered first-aid treatment to a wounded laborer until a physician's services could be secured.

TENTH DISTRICT.

Edward Pfister, keeper, Conneaut Harbor Light Station, Ohio, assisted the disabled lighter *T. F. Newman*, in tow of the tug *Oregon*, which was wrecked on the breakwater in vicinity of the station. Seven men on the scow were taken off by Pfister with a small boat and were provided with food and lodging.

The launch of the tender *Crocus*, Fred Herbert commanding, rescued a party of six persons from the gasoline cruiser *Aurora*, of Cleveland, which had run aground on a sand bar off Cedar Point, Ohio, and furnished them food and shelter overnight.

On May 2, 1922, W. E. Montonna, keeper, Tibbetts Point Light Station, N. Y., supplied the fish tug *Cole*, of Cape Vincent, N. Y., with gasoline to enable it to reach port.

W. E. Montonna, keeper, Tibbetts Point Light Station, N. Y., furnished the cabin cruiser *Miss Esther May*, of Oswego, N. Y., sufficient gasoline to enable it to reach port.

On May 22, 1922, Frank Ritter, keeper, Sandusky Bay Inner Range Light Station, Ohio, towed, a disabled sailing yacht with five persons aboard to port.

ELEVENTH DISTRICT.

Otto Redman, keeper, and James T. Story, assistant keeper, Windmill Point Light Station, Mich., rescued two persons who had become exhausted in the water, and aided in the recovery of the body of a boy who had drowned near by.

Harry Keonlway, keeper, R. E. Dissett, first assistant keeper, and L. C. DeRusha, second assistant keeper, Detroit River Light Station, Mich., rescued six persons from a burning yacht, took them to the station, and later placed them aboard a passing steamer.

TWELFTH DISTRICT.

Frank A. Drew, keeper, Green Island Light Station, Wis., rendered assistance to the disabled fishing tug *Loyd*, and towed same from the station to Marinette, Wis., after temporary repairs had been made at the station.

Charles Bavry, keeper, Rolla Paris, first assistant keeper, and Carl K. Nufus, second assistant keeper, Grand Haven Light Station, Mich., rescued two young men whose canoe capsized near station.

Joseph Napiezinski, keeper, Ross Wright, first assistant keeper, and Edward Carron, second assistant keeper, Manitowoc Breakwater Light Station, Wis., rendered assistance in recovering the body of a woman who had drowned near by.

James P. Burdick, keeper, George J. Meengs, first assistant keeper, and John K. Tobin, second assistant keeper, South Manitou Light Station, Mich., rendered assistance in taking passengers ashore from mail boat *Violet* which was caught fast in an ice floe, offshore in the vicinity of the station.

THIRTEENTH DISTRICT.

Charles L. Abney, lamplighter in charge of Rock River Light, above, upper Mississippi River, lost his life trying to save two girls from drowning at the lower entrance to Lock 32, Illinois and Mississippi Canal.

SIXTEENTH DISTRICT.

John C. Johnson, keeper, and B. J. Lervick, assistant keeper, Tree Point Light Station, Alaska, towed the disabled gas boat *Ray* with two men on board into harbor.

George Stinson, keeper, Eldred Rock Light Station, Alaska, rendered assistance to a launch, with two men aboard, and furnished them food, lodging, and fuel.

SEVENTEENTH DISTRICT.

Robert Gerlof, keeper, Howard L. Hansen, first assistant keeper, and Walter T. Lawrence, second assistant keeper, Tillamook Rock Light Station, Oreg., picked up a man drifting in a helpless condition from exposure, rescued his launch and furnished him food and lodging at the station.

Albert Bever, keeper, William Hill, assistant keeper, and Harvey A. Walker, third assistant keeper, Destruction Island Light Station, Wash., rendered assistance to a disabled launch which had drifted helplessly for 20 hours. The three men in the boat were cared for by the keepers until it was practicable for them to leave the station.

Shirley Cowan, first assistant keeper, Cape Flattery Light Station, Wash., assisted in pulling the gasoline boat *D. & M.* off the beach 5 miles north of Umatilla Reef, coast of Washington; also picked up a disabled launch with two men 6 miles south of Umatilla Reef, Wash., which had been adrift for 30 hours, and towed it to Neah Bay, about 30 miles distant.

Shirley Cowan, first assistant keeper, Cape Flattery Light Station, Wash., rendered assistance to a man, his wife, and two babies, who were on the gas boat *Rambler* wrecked on the beach south of the Hoh River, Wash. He also furnished them food and clothing, and the following day took them to Mora, Wash.

Shirley Cowan, first assistant keeper, Cape Flattery Light Station, Wash., in a southeast storm pulled the gas boat *Sea Rover* off the North Spit at the mouth of the Quillayute River, Wash.

Bernard B. Meagher, keeper, Smith Island Light Station, Wash., furnished food and lodging to five members of the crew of a hydroplane which had landed at the station during a storm.

George L. Lonholt, keeper, and Hans F. Jensen, assistant keeper, Patos Islands Light Station, Wash., assisted in repairing the launch *Meteor*, and cared for the five occupants thereof.

George L. Lonholt, keeper, Patos Islands Light Station, Wash., assisted the auxiliary yacht *Aquila* which became disabled off the light station, and furnished shelter to the occupants while the engine was being repaired.

George L. Lonholt, keeper, Patos Islands Light Station, Wash., assisted the launch *Verona*, of Seattle, Wash., which was overtaken by a heavy storm when off Patos Island Light Station; 10 passengers of the boat were cared for at the station for two days, until the weather moderated.

George L. Lonholt, keeper, Patos Islands Light Station, Wash., assisted the disabled launch *Meteor*; its captain and engineer and the wife and two children of the former were cared for at the light station until a launch was procured to tow the boat to Anacortes, Wash.

EIGHTEENTH DISTRICT.

Hermann Engel, keeper, Ballast Point Light Station, Calif., rescued a little girl from drowning; also rescued two women who had drifted out to sea in a small skiff.

Harry H. Hoddinott, assistant keeper, Ballast Point Light Station, Calif., assisted a harbor pilot in rescuing two men who were in a disabled fishing boat.

Thomas G. Thomson, keeper, Charles H. Levesay, first assistant keeper, and Lester E. Shanafelt, second assistant keeper, Humboldt Bay Fog Signal and Light Station, Calif., rendered service in trying to revive a fisherman who drowned near the station.

Hermann Engel, keeper, and Harry H. Hoddinott, assistant keeper, Ballast Point Light Station, Calif., assisted in securing help to float the schooner *Pacific*, which grounded at Ballast Point; also rescued two men from a sinking United States Army airplane.

Otto Winkelmann, quartermaster, lighthouse tender *Madrono*, attempted to rescue a fireman from drowning.

Frank Weller, first assistant keeper, Los Angeles Harbor Light Station, Calif., rescued two men who had been wrecked.

NINETEENTH DISTRICT.

Edward E. Robins, keeper, Honolulu Harbor Light Station, Hawaii, rescued two men and two boys who had been adrift two hours on an overturned skiff, and towed the skiff to shore with the station launch.

The lighthouse tender *Kukui*, Capt. Ole Eriksen commanding, assisted in pulling off the steamer *Fairfield City*, which was aground on the reef near the entrance to Honolulu Harbor.

The lighthouse tender *Kukui*, Capt. Ole Eriksen commanding, raised a United States Army airplane which had sunk in 25 feet of water in Honolulu Harbor after a forced landing, and placed it on a scow for transporting to the air base.

William Jones, seaman, lighthouse tender *Kukui*, assisted in recovering an Army airplane which had sunk in Honolulu Harbor, by diving three times to a depth of 25 feet and making hoisting tackle fast to the sunken airplane.

The lighthouse tender *Kukui*, Capt. Ole Eriksen commanding, rendered assistance in raising and salvaging the cargo of the U. S. Army Quartermaster transport *V-10*, which had capsized and sunk alongside the dock at Honolulu.



APPROPRIATIONS FOR THE BUREAU OF LIGHTHOUSES AND THE LIGHTHOUSE SERVICE, SIXTY-SIXTH CONGRESS, THIRD SESSION, AND SIXTY-SEVENTH CONGRESS, SECOND SESSION, 1921-22, NOT LISTED IN PREVIOUS ANNUAL REPORT.

Title.	Act.	Amount.
Maintenance:		
Salaries, Bureau of Lighthouses, 1923.....	Commerce and Labor, Mar. 28, 1922.	\$68,290.00
General expenses, Lighthouse Service, 1923.....	do.....	4,200,000.00
Salaries, keepers of lighthouses, 1923.....	do.....	1,300,000.00
Salaries, lighthouse vessels, 1923.....	do.....	1,700,000.00
Salaries, Lighthouse Service, 1923.....	do.....	400,000.00
Retired pay, Lighthouse Service, 1923.....	do.....	80,000.00
Total.....		7,748,290.00
Special works:		
Repairing and rebuilding aids to navigation, seventh light- house district, 1922-23.....	Deficiency, Mar. 20, 1922..	60,000.00
Aids to navigation, Raritan Bay and connected waters, N. Y. and N. J.....	Commerce and Labor, Mar. 28, 1922.	100,000.00
Aids to navigation, Delaware Bay Entrance.....	do.....	138,000.00
Aids to navigation, Florida coasts, Fla.....	do.....	50,000.00
San Juan Lighthouse Depot, P. R.....	do.....	60,000.00
Detroit Lighthouse Depot, Mich.....	do.....	50,000.00
Spectacle Reef Light Station, Mich.....	do.....	14,500.00
Aids to navigation, Calumet Harbor, Ill.....	do.....	66,000.00
Aids to navigation, Alaska.....	do.....	125,000.00
Damage claims, collisions of vessels.....	Deficiency, Mar. 20, 1922; deficiency, July 1, 1922.	1,342.47
Total.....		664,842.47
Grand total.....		8,413,132.47

EXPENDITURES DURING THE FISCAL YEAR 1922 FROM APPROPRIATIONS FOR THE LIGHTHOUSE SERVICE.

[Obligations incurred are not included.]

Salaries:		
Bureau of Lighthouses, 1921.....		\$2,906.89
Bureau of Lighthouses, 1922.....		64,897.87
General expenses, Lighthouse Service:		
1920.....		76,037.28
1921.....		968,943.67
1922.....		3,350,559.01
Certified claims.....		51,409.64
Salaries of keepers of lighthouses:		
1920.....		60.00
1921.....		35,108.63
1922.....		1,258,973.89
Salaries, lighthouse vessels:		
1921.....		72,282.93
1922.....		1,637,760.40
Salaries, Lighthouse Service:		
1921.....		4,513.81
1922.....		392,630.06
Increase of compensation, Department of Commerce:		
1921.....		27,372.17
1922.....		878,387.23
Retired pay, Lighthouse Service:		
1921.....		1,665.28
1922.....		71,944.11
Total maintenance.....		8,895,452.87

SPECIAL WORKS.

General:		
Repairing and rebuilding aids to navigation, Atlantic coast.....		33,435.61
Light vessels for general service.....		47.47
Radio installations on lighthouse tenders.....		5,053.52
Vessels for Lighthouse Service.....		589,354.68
Light keepers' dwellings.....		13,396.04
Claims for damages by collision of lighthouse vessels.....		843.27
Second district:		
Nantucket Harbor Fog Signal, Massachusetts.....		2,489.25
Depot for second lighthouse district.....		14,721.89



ITEMIZED ESTIMATES OF APPROPRIATIONS FOR THE FISCAL YEAR 1924, AND ITEMIZED STATEMENTS OF EXPENDITURES FOR THE FISCAL YEARS 1922 AND 1923, AS REQUIRED BY THE ACT OF CONGRESS APPROVED JUNE 10, 1921 (42 STAT., 20).

[The expenditures herein stated are in part estimated, owing to the fact that all obligations incurred for the year 1922 have not yet been settled. Articles of supplies purchased for general stock have also been distributed, approximately, to features to be benefited. This table refers to appropriations made in the Departments of Commerce and Labor appropriation act, but does not include bureau salaries in Washington nor the cost of publications otherwise provided for. This statement contains also amounts for salaries and wages under certain items which are shown separately in the Book of Estimates, 1924.]

Item.	Estimated expenditure, 1924.	Estimated expenditure, 1923.	Expended and obligated, 1922.
GENERAL EXPENSES, LIGHTHOUSE SERVICE.			
Personal services.....	\$475,000	\$460,000	\$459,925
Supplies and materials:			
Stationery and office supplies.....	20,000	20,000	21,941
Medical and hospital supplies.....	000	700	750
Scientific and educational supplies.....	1,000	1,200	1,260
Fuel.....	925,000	975,000	921,433
Wearing apparel and sewing supplies.....	1,600	1,800	1,865
Provisions.....	9,500	10,000	10,200
Sundry supplies.....	145,000	150,000	149,726
Materials.....	200,000	200,000	205,651
Total supplies and materials.....	1,302,700	1,358,700	1,312,876
Subsistence and support of persons (service).....	702,500	702,000	700,224
Subsistence and care of animals and storage and care of vehicles (service).....	500	500	625
Communication service:			
Telegraph service.....	2,500	2,500	2,736
Telephone service.....	9,000	9,000	9,574
Other communication service (postage).....	400	400	425
Total communication service.....	11,900	11,900	12,735
Travel expenses.....	37,500	38,000	38,575
Transportation of things (service).....	125,000	128,000	129,928
Photographing and making photographs and prints.....	50	60	75
Advertising and publication of notices (service).....	1,250	1,300	1,358
Furnishing of heat, light, power, water, and electricity (service).....	12,000	12,500	12,746
Rent of buildings and structures.....	8,700	8,700	8,700
Repairs and alterations.....	1,090,000	1,050,000	1,056,904
Special and miscellaneous current expenses.....	25,000	25,100	26,195
Burial expenses.....	300	300	275
Equipment:			
Furniture, furnishings, and fixtures.....	6,500	7,000	6,743
Educational, scientific, and recreational equipment.....	400	400	360
Other equipment.....	280,000	278,000	280,829
Total equipment.....	286,900	285,400	297,932
Land and interests in land.....	1,000	1,000	2,225
Structures and parts, and nonstructural improvements to land (includes fixed equipment):			
Other structures.....	113,000	110,000	113,538
Nonstructural improvements.....	6,700	6,500	6,748
Total structures and nonstructural improvements.....	119,700	116,500	120,386
Grand total, general expenses.....	4,200,000	4,200,000	4,191,394
Appropriation, 1923.....	\$4,200,000		
Appropriation, 1922.....	4,200,000		
SALARIES OF KEEPERS OF LIGHTHOUSES.			
Salaries of lighthouse keepers.....	\$1,300,000	\$1,300,000	\$1,294,716
Appropriation, 1923.....	\$1,300,000		
Appropriation, 1922.....	1,300,000		

ITEMIZED ESTIMATES OF APPROPRIATIONS FOR THE FISCAL YEAR 1924, ETC.—CON.

Item.	Estimated expenditure, 1924.	Estimated expenditure, 1923.	Expended and obligated, 1922.
SALARIES, LIGHTHOUSE VESSELS.			
Salaries and wages, lighthouse tenders.....	\$1,025,000	\$1,027,000	\$1,075,105
Salaries and wages, light vessels.....	610,000	613,000	615,019
Total.....	1,635,000	1,640,000	1,690,124
Appropriation, 1923.....	\$1,700,000		
Appropriation, 1922.....	1,800,000		
SALARIES, LIGHTHOUSE SERVICE.			
Salaries, authorized district office, technical and depot forces...	460,000	400,000	397,749
Appropriation, 1923.....	\$400,000		
Appropriation, 1922.....	400,000		
RETIRED PAY, LIGHTHOUSE SERVICE.			
Retirement pay.....	85,000	80,000	74,799
Appropriation, 1923.....	\$80,000		
Appropriation, 1922.....	75,000		

SUMMARY OF ESTIMATES OF APPROPRIATIONS FOR THE LIGHTHOUSE SERVICE FOR THE FISCAL YEAR 1924.

FOR GENERAL MAINTENANCE OF THE LIGHTHOUSE SERVICE.

Salaries, Bureau of Lighthouses.....	\$92,820
General expenses, Lighthouse Service.....	4,207,000
Salaries, keepers of lighthouses.....	1,300,000
Salaries, lighthouse vessels.....	1,700,000
Salaries, Lighthouse Service.....	460,000
Retired pay, Lighthouse Service.....	85,000
Total.....	7,837,820

FOR SPECIAL WORKS.

Group 1. Works urgently necessary for the safety or immediate needs of navigation and for the preservation of existing structures or equipment, for the full utilization of other public improvements, or for the efficient equipment of the Lighthouse Service:

1. Constructing or purchasing and equipping tenders and light vessels.....	1,010,000
2. Lighthouse depot for fifth district, enlargement, improvement, or establishment of new depot.....	275,000
3. Cape Spencer, Alaska, establishment of light and fog-signal station.....	165,000
4. Newport, R. I., Lighthouse Depot.....	82,300
5. Radio fog-signal installations.....	25,000
6. Stannard Rock Light Station, Mich.....	30,000
7. Galveston Bay and Houston Channel, Tex., aids to navigation.....	125,000
8. Depot for second lighthouse district, completion.....	71,000
9. Potomac River, Md., aids to navigation.....	90,000
10. Ludington, Mich., aids to navigation.....	70,000
11. Florida, west coast, repairs and improvements.....	34,200
12. Sandusky Bay, Ohio, aids to navigation.....	105,200
13. Fairport Harbor, Ohio, aids to navigation.....	39,400
14. Erie, Pa., and vicinity, aids to navigation.....	38,500
15. Marquette, Mich., Light Station, improvements.....	15,000
16. Grays Harbor, Wash., Light Station, improvements.....	20,000
17. Ediz Hook, Wash., Lighthouse Depot.....	12,000
Authorized by law.....	\$1,505,000
Not authorized.....	702,600
Total, group 1.....	2,207,600

Group 2. Works considered essential for the needs of navigation and the equipment of the Lighthouse Service, and which it is recommended be undertaken as resources permit, are submitted with estimate of cost. These items have been recommended by the superintendents of the lighthouse districts:

FIRST LIGHTHOUSE DISTRICT.

Tumbler Island, Me., establishment of light.....	5,800
Otter Island, Me., establishment of light.....	3,600
Ram Island, Me., establishment of light.....	6,000
Portland, Me., depot for first lighthouse district.....	180,000
Rockland, Me., Lighthouse Depot.....	28,600

SECOND LIGHTHOUSE DISTRICT.

Woods Hole, Mass., Lighthouse Depot, improvements.....	\$18,000
Second lighthouse district, riprap protection for light stations.....	17,250
Cape Cod, Mass., Light Station, improvements.....	5,620
Brant Point, Mass., Light Station, improvements.....	5,000

THIRD LIGHTHOUSE DISTRICT.

Great Salt Pond, R. I., Light Station, completion.....	53,000
Staten Island, N. Y., Lighthouse Depot, machine shop.....	15,000
Coney Island, N. Y., Light Station, right of way.....	5,000
Staten Island, N. Y., Lighthouse Depot, extension of wharves.....	119,600
Staten Island, N. Y., Lighthouse Depot, storage buildings.....	80,000
Sag Harbor, N. Y., improvements and establishment of new aids to navigation.....	58,500
Third lighthouse district, riprap protection for light stations.....	136,000

FOURTH LIGHTHOUSE DISTRICT.

Edgemoor, Del., Lighthouse Depot, improvements.....	52,000
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FIFTH LIGHTHOUSE DISTRICT.

Norfolk, Va., to Beaufort, N. C., inland waterway, aids to navigation.....	92,000
Cape Henry, Va., Light Station, improvements.....	24,300

SIXTH LIGHTHOUSE DISTRICT.

Charleston, S. C., Lighthouse Depot, completion.....	50,000
Sixth lighthouse district, additional gas buoys.....	60,000

SEVENTH LIGHTHOUSE DISTRICT.

Depot for seventh lighthouse district.....	225,000
Tampa Bay, Fla., aids to navigation.....	17,500
Lake Okechobee and Hicpochee, Fla., establishment of aids to navigation.....	85,000
Florida, west coast, repairs and improvements.....	33,800
Florida Reefs and Keys, Fla., aids to navigation.....	185,000

EIGHTH LIGHTHOUSE DISTRICT.

Depot for eighth lighthouse district.....	132,750
Sand Island, Ala., Light Station, keepers' dwelling.....	12,000

NINTH LIGHTHOUSE DISTRICT.

Virgin Islands, West Indies, aids to navigation.....	40,000
Port Real, P. R., establishment of light station.....	40,000
San Juan, P. R., office building.....	27,000

TENTH LIGHTHOUSE DISTRICT.

Oswego Harbor, N. Y., aids to navigation.....	13,000
Charlotte, N. Y., Light Station, improvements.....	46,000
Thirty-Mile Point, N. Y., aids to navigation.....	32,500

ELEVENTH LIGHTHOUSE DISTRICT.

West Neebish Channel, St. Marys River, Mich., aids to navigation.....	50,000
Michigan Island, Wis., establishment of light and fog-signal station.....	85,000
Portage Lake, Mich., aids to navigation.....	70,000
Lake of the Woods, Minn., aids to navigation.....	7,000

TWELFTH LIGHTHOUSE DISTRICT.

Lansing Shoal, Mich., establishment of light and fog-signal station.....	300,000
Sturgeon Bay, Wis., aids to navigation.....	49,000
Escanaba, Mich., Light Station, improvements.....	70,000
Two Rivers, Wis., improvements.....	7,400
Manitowoc, Wis., Light Station, keepers' dwellings.....	17,500

SIXTEENTH LIGHTHOUSE DISTRICT.

Ketchikan, Alaska, Lighthouse Depot, completion.....	65,000
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SEVENTEENTH LIGHTHOUSE DISTRICT.

Washington and Oregon, aids to navigation.....	50,000
Brush Point, Wash., establishment of light and fog-signal station.....	46,000
Alki Point, Wash., Light Station, improvements.....	3,000
Cape Lookout, Oreg., establishment of light and fog-signal station.....	150,000

EIGHTEENTH LIGHTHOUSE DISTRICT.

Goat Island, Calif., Depot, keepers' dwellings.....	16,500
California, aids to navigation.....	25,000
Goat Island, Calif., Lighthouse Depot, improvements.....	73,000
Red Rock, Calif., light and fog signal.....	14,000
Point Pinos, Calif., Light Station, improvements.....	16,500
Santa Barbara, Calif., Light Station, improvements.....	20,000
Piedras Blancas, Calif., dwelling for assistant keepers.....	6,500
Point Montara, Calif., dwelling for assistant keeper.....	6,500

NINETEENTH LIGHTHOUSE DISTRICT.

Honolulu, Hawaii, establishment of depot.....	\$120,000
Cape Kumukahi, Hawaii, establishment of light.....	28,000
Kauahoa Point, Hawaii, improvements.....	22,000
Total group 2 (not included in total of estimates).....	3,222,720

RECAPITULATION.

For general maintenance of the Lighthouse Service.....	7,837,820
For special works, group 1.....	2,207,600
Total.....	10,045,420

DETAILED ESTIMATES FOR MAINTENANCE, 1924.

BUREAU OF LIGHTHOUSES.

Salaries.....	\$92,820
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GENERAL EXPENSES, LIGHTHOUSE SERVICE.

For supplies, repairs, maintenance, and incidental expenses of lighthouses and other lights, beacons, buoyage, fog signals, lighting of rivers heretofore authorized to be lighted, light vessels, other aids to navigation, and lighthouse tenders, including the establishment, repair, and improvement of beacons and day marks and purchase of land for same; the establishment of post lights, buoys, submarine signals, and fog signals; the establishment of oil or carbide houses not to exceed \$10,000: *Provided*, That any oil or carbide house erected hereunder shall not exceed \$1,000 in cost; the construction of necessary outbuildings at a cost not exceeding \$1,000 at any one light station in any fiscal year; the improvements of grounds and buildings connected with light stations and depots; restoring light stations and depots and buildings connected therewith: *Provided*, That such restoration shall be limited to the original purpose of the structures; wages of persons attending post lights; pay of temporary employees and field force while engaged on works of general repairs and maintenance and pay of laborers and mechanics at lighthouse depots; rations and provisions or commutation thereof for keepers of lighthouses, working parties in the field, officers and crews of light vessels and tenders, and officials and other authorized persons of the Lighthouse Service on duty on board of such tenders or vessels; and money accruing from commutation for rations and provisions for the above-named persons on board of tenders and light vessels or in working parties in the field may be paid on proper vouchers to the person having charge of the mess of such vessel or party; reimbursement under rules prescribed by the Secretary of Commerce of keepers of light stations and masters of light vessels and of lighthouse tenders for rations and provisions and clothing furnished shipwrecked persons who may be temporarily provided for by them, not exceeding in all, \$5,000 in any fiscal year; fuel and rent of quarters, or commutation thereof, where necessary for keepers of lighthouses; the purchase of land sites for fog signals; the rent of necessary ground for all such lights and beacons as are for temporary use or to mark changeable channels and which in consequence can not be made permanent; the rent of offices, depots, and wharves; traveling expenses, mileage, library books for light stations and vessels, and technical books and periodicals not exceeding \$1,000; traveling and subsistence expenses of teachers while actually employed by States or private persons to instruct the children of keepers of lighthouses; and for all other contingent expenses of district offices and depots and not exceeding \$8,500 for contingent expenses of the office of the Bureau of Lighthouses in the District of Columbia, \$4,200,000.

NOTE.—The estimate submitted is the same as the appropriations for 1923. There is still much important work of repair and upkeep necessary to restore stations, vessels, etc., to normal condition, owing to the fact that this work had fallen behind during the war period, when prices were high and funds insufficient. The total estimates submitted by lighthouse superintendents as essential to proper maintenance of the service for the fiscal year 1924 were approximately \$5,000,000.

SALARIES, KEEPERS OF LIGHTHOUSES.

For salaries of not exceeding 1,800 lighthouse and fog-signal keepers and persons attending other lights, exclusive of post lights, \$1,300,000.

NOTE.—This estimate is the same as the amount appropriated for the fiscal year 1923, and provides as follows:

1,180 keepers and assistant keepers, at average pay of \$840.....	\$1,243,200
Persons attending other lights.....	66,000
Total.....	1,309,200

SALARIES, LIGHTHOUSE VESSELS.

For salaries and wages of officers and crews of light vessels and lighthouse tenders, including temporary employment when necessary, \$1,700,000.

NOTE.—The amount estimated is the same as the appropriation for the fiscal year 1923.

SALARIES, LIGHTHOUSE SERVICE.

For salaries of 17 superintendents of lighthouses and of assistant superintendents, clerks, draftsmen, and other authorized permanent employees in the district offices and depots of the Lighthouse Service, exclusive of those employed in the office of the Bureau of Lighthouses, District of Columbia: *Provided*, That the salaries of two superintendents of lighthouses shall not exceed \$5,500 each, of five shall not exceed \$5,000 each, of seven shall not exceed \$4,500 each, and of three shall not exceed \$4,000 each, \$460,000.

NOTE.—This estimate is \$30,000 more than the appropriation for 1923, but it is the same as the estimate submitted for that year. This increase is due to urgent necessity for increasing the compensation of certain of the more responsible officers and employees in the lighthouse districts whose pay has been very inadequate for a number of years and who have received very little consideration in recent years. The compensation of these responsible and mostly technical positions is far too low in proportion not only to other Government services, but to other classes in the Lighthouse Service itself, who received war-time adjustments. The effect is demoralizing and is causing the more competent young men to seek other services. The increases affect only 106 persons, who have been selected as the most meritorious cases. The district superintendents of lighthouses especially are at present greatly underpaid in comparison with technical positions of similar responsibility in other branches of the Government and outside, and also in comparison with employees under their direction, many of whom are now receiving the same or greater compensation. A fair compensation for the district superintendents is extremely important for the future welfare of the Lighthouse Service. Any competent comparison of the responsibilities and qualifications of these positions will show that there certainly should be no discrimination against the district officers of the Lighthouse Service. The existing discrepancies of compensation are extreme and affect the morale of this service. The estimate includes only five additional positions—three watchmen, one draftsman, and one radio expert—all of whom are necessary for the efficient conduct of the work.

RETIRED PAY, LIGHTHOUSE SERVICE.

For retired pay of officers and employees in the field service and on vessels of the Lighthouse Service, except persons continuously employed in district offices and shops, \$85,000.

NOTE.—The act of June 20, 1918, provides: "That hereafter all officers and employees engaged in the field service or on vessels of the Lighthouse Service, except persons continuously employed in district offices or shops, who shall have reached the age of sixty-five years, after having been thirty years in the active service of the Government, may, at their option, be retired from further performance of duty, and all such officers and employees who shall have reached the age of seventy years shall be compulsorily retired from further performance of duty: *Provided*, That the annual compensation of persons so retired shall be a sum equal to one-fortieth of the average annual pay received for the last five years of service for each year of active service in the Lighthouse Service or in a department or branch of the Government having a retirement system, not to exceed in any case thirty-fortieths of such average annual pay received: *Provided further*, That such retirement pay shall not include any amount on account of subsistence or other allowance." The amount required under this appropriation will necessarily increase gradually for a few years, as the number of persons annually becoming eligible to the benefit is greater than the number of retired employees who decess. The appropriation for 1919 was \$30,000 and has been slightly increased each subsequent year. Eventually, however, the amount required will become practically stationary.

DETAILED ESTIMATES FOR SPECIAL WORKS, 1924.

GROUP No. 1.

Works urgently necessary for the safety or immediate needs of navigation and for the preservation of existing structures or equipment, for the full utilization of other public improvements or for the efficient equipment of the Lighthouse Service:

No. 1. *Lighthouse vessels, general service.*—Constructing or purchasing and equipping lighthouse tenders and light vessels for the Lighthouse Service, \$1,010,000.

NOTE.—The act of June 5, 1920 (41 Stat. 1058), authorized \$5,000,000 for new lighthouse tenders and light vessels and an appropriation of \$1,000,000 was made therefor by the act of March 4, 1921 (41 Stat. 1416). Under this appropriation contracts have been let for the construction of five light vessels. Careful estimates and examinations as to the condition and further serviceability of vessels of the Lighthouse Service show that it is very necessary to take prompt measures for replacing the older and worn-out vessels of the service. Immediate provisions should be made for the 8 vessels (additional to those under construction) covered by this item. This is considered indispensable, not only to the efficient operation of the Lighthouse Service in the protection of shipping, but for the reasonable safeguarding of the lives of those employed on vessels of this service. The extent of the work required at this time is due to lack of sufficient appropriations for a number of years back to keep up a proper rebuilding program and to war conditions. None of the light vessels is for a new station, all being to replace vessels worn out in service. In view of the time required to design, contract for, build, and complete vessels funds to carry out this plan should be provided as rapidly



Site for new depot.....	\$40,000
Piling, 300 piles, at \$80 each.....	24,000
Concrete dock, 350 cubic yards, at \$30 per cubic yard.....	10,500
20,000 feet timber, at \$165 per 1,000 board feet.....	3,300
Storehouse, 15,000 cubic feet, at 30 cents per cubic feet.....	4,500
Total.....	82,300

No. 5. *Radio fog-signal installations*.—Installation and development of radio fog signals at or near lighthouses and light vessels, \$25,000.

NOTE.—The greatest need at the present time for increasing the safety of navigation is for more efficient fog signals. The development of radio apparatus and of means of accurately obtaining the direction of radio signals with the radio compass prove that radio apparatus is of great value for the location of ships in fog, thick weather, or beyond the range of visible signals. This item is for the purpose of further applying radio signals to this important work of the Lighthouse Service. This apparatus consists of a radio-sending station at a lighthouse on shore or on a light vessel at sea from which definite signals are sent out at regular intervals in the same manner as from a whistle or bell. The signals, are, however, picked up on shipboard by means of a radio compass, an instrument which gives the direction of the source of the radio signal. This system has many advantages, some of which are: (1) It is capable of easy installation and operation without any additional personnel; (2) it requires no knowledge of radio apparatus or the telegraph code for its use; (3) any number of vessels at sea may obtain their position without interference in the minimum amount of time; (4) it permits the navigator to take his own bearings without depending on others for accuracy, thus placing the responsibility for the safe navigation of the vessel where it properly belongs. It is proposed to establish radio direction signal stations at the most important harbor entrances and other prominent points on the Atlantic and Pacific coasts. Detailed estimate:

Installation of 4 stations, at \$6,000.....	\$24,000
Contingencies.....	1,000
Total.....	25,000

No. 6. *Stannard Rock Light Station, Mich.*—Repairs and improvements to Stannard Rock Light Station, Mich., \$30,000.

NOTE.—This station was damaged during the winter of 1921–22, when the steel shell surrounding the circular concrete foundation of the station was torn off by the action of ice, leaving the concrete work unprotected and subject to serious injury by water and ice. It is proposed to construct a new steel shell of improved design 3 feet outside the surface of the concrete foundation and extending 10 feet above and 10 feet below water level, this shell being firmly attached to the present concrete and reinforcing steel placed in the 3-foot space between the two, with wooden forms above and below the new steel sheathing.

It is proposed further to improve the station by installing a fog signal of a modern type, operated by compressed air, to replace the inadequate fog signal now in place; also a radiotelephone equipment, which is desirable both in the operation of this very isolated station and in facilitating the proposed repair work. A deficiency estimate for this project, in the sum of \$50,000, was approved by the President June 5, 1922, and transmitted to Congress, but no appropriation was made therefor. It has been found possible to purchase materials amounting to about \$20,000 from the general appropriation for repairs, with a view to getting the work started, but its completion under the same appropriation is not practicable. Therefore an appropriation of \$30,000 is asked. Detailed estimate:

Clearing around pier.....	\$1,000
Concrete in place, 780 cubic yards, at \$15 per cubic yard.....	11,700
Drilling anchorage holes.....	1,500
Boat hire (transporting men and materials).....	3,000
Placing steel and reinforcing iron.....	2,000
Radiotelephone installation.....	3,500
Installing fog signal.....	800
Contingencies.....	6,500
Total.....	30,000

No. 7. *Galveston Bay and Houston Channel, Tex., aids to navigation*.—Improving existing aids to navigation and establishing new aids in Galveston Harbor and Bay and along the Houston Channel in Galveston Bay from Bolivar Roads to Morgan Point, Tex., \$125,000.

NOTE.—The oil gas buoys now in service in Galveston Bay are very old, of an obsolete type, and unreliable and unsatisfactory to maritime interests. The commerce of Galveston, Texas City, and Houston is very large. The exports and imports of Galveston alone during the year 1921 were approximately \$585,756,221. The shipping out of Texas is large and important. The commerce of the Port of Houston is assuming great importance, and the improvement of the channel, including work now authorized, will represent an expenditure of over \$10,000,000. Therefore, this amount is imperatively required in order to properly mark the channels leading to the three important ports in question. Detailed estimate:

Gas and bell buoys (18), at \$4,562.....	\$82,106
Chain, ballast balls, and other moorings.....	7,894
Building 13 compressed acetylene lights in water: Minor lights, pyramidal structure, 66½ cents per cubic foot (5,769 cubic feet each, 75,000 cubic feet in all).....	50,000
Constructing or purchasing a suitable patrol boat for tending aids to navigation in Galveston Bay and Houston Channel.....	15,000
Total.....	155,000

No. 8. *Depot for second lighthouse district*.—Completing the construction and equipment of a lighthouse depot for the second lighthouse district, \$71,000.

NOTE.—The act of July 1, 1918 (40 Stat. 686), appropriating \$85,000 for dredging two slips, building retaining walls to same, rebuilding wharf, building service building and oil house, etc., at Chelsea, Mass.,

was based upon estimates made in 1911. The great advance in cost of building materials and labor since the original estimate for this project was submitted, notwithstanding some recent reductions, makes the appropriation inadequate for the purpose intended. The lighthouse depot in the northern end of the second district, which was located on Lovells Island, about 9 miles from Boston, on land belonging to the War Department and urgently required by them for war purposes, greatly handicapped the work of the district and increased the duties of the tenders by having the base of supplies located nearly an hour's steaming from Boston. The new depot at Chelsea should be properly equipped at the earliest practicable date. Detailed estimate:

Dredging two slips and in front, 21,000 yards, at \$0.80.....	\$16,800
Filling and grading, 300 yards, at \$4.....	1,200
Carpenter shop and storehouse, 35 by 80 feet, 43,200 cubic feet, at \$0.75.....	32,400
Sinker platform, 1,500 square feet, at \$2.....	3,000
Boundary fence, 270 linear feet, at \$8.....	2,160
Railroad, 1,800 feet, at \$3.....	5,400
Push cars (2), at \$200.....	400
Machine shop equipment.....	7,000
Contingencies.....	2,640
Total.....	71,000

No. 9. *Potomac River, Md., aids to navigation.*—Improving the aids to navigation and establishing new aids on the Potomac River, Md., \$90,000.

NOTE.—The act of June 20, 1918 (40 Stat. 608), authorized this work, but no appropriation was made therefor. The Potomac River is the most poorly lighted and marked of the important navigable rivers of the United States, a condition which should not be allowed to continue, because of its relation to the National Capital and many Government activities, and its increased navigational importance. There are urgent requests from steamship companies for improvements in the lighting and marking of the Potomac River. The Potomac River from Maryland Point to Washington, about 40 nautical miles, is now lighted by only four gas buoys, five minor lights, and one lighthouse. The gas buoys are of low candlepower and are of necessity removed from station for several months in the winter, on account of ice conditions. The minor lights are all fixed white or red lights of low candlepower, located on wharves or on timber structures, which are liable to destruction by ice in the winter. Jones Point Light Station is of little use on account of changes in shore line at this point. It is proposed to establish nine lights, nine fog signals, move one light, change two fog signals from bells to horns, change two spar buoys to tall-type cans, replace one spar buoy with a bell buoy, establish a gas buoy, and convert seven oil gas buoys to acetylene gas buoys. Jones Point Light Station and the five minor lights above mentioned may then be discontinued. Detailed estimate:

Site for 1 light station, 3 acres, at \$333.33.....	\$1,000
1 dwelling, 30 by 40 feet, frame, 14,286 cubic feet, at \$0.35 per cubic foot.....	5,000
6 light towers, frame, 20 feet high, 6,000 cubic feet, at \$0.30 per cubic foot.....	1,800
1 light tower, iron pipe, 25 feet high.....	710
2 fog-signal houses, 15 by 20 by 8 feet, brick, 4,800 cubic feet, at \$0.50 per cubic foot.....	2,400
6 fog-signal houses, at \$100 each.....	600
1 fog-signal tower, 2,000 cubic feet, at \$0.30 per cubic foot.....	600
Illuminating apparatus for 9 stations.....	7,750
Fog-signal apparatus for 11 stations.....	20,600
Transfer of one tower.....	100
Two light stations on caissons, cast iron, filled with concrete:	
Steel-sheet submarine stations, 26,000 pounds, at \$0.25 per pound.....	6,500
Cast-iron submarine stations, 25,000 pounds, at \$0.15 per pound.....	3,750
Concrete submarine stations, 260 cubic yards, at \$35 per cubic yard.....	9,100
Piling, staging, erecting.....	5,300
Towers, hardware, etc.....	850
Riprap, 1,200 tons, at \$12 per ton.....	14,400
Buoys, 2 tall cans, at \$500 each.....	1,000
Buoy, one gas.....	4,400
Buoy, one bell.....	1,200
Chain, sinkers, shackles, and swivels for buoys.....	2,900
Total.....	90,000

No. 10. *Ludington, Mich., aids to navigation.*—Improving aids to navigation and establishing new aids at Ludington, Mich., \$70,000.

NOTE.—The act of June 5, 1920 (41 Stat. 1058) authorized this work in the sum of \$50,000, but no appropriation was made therefor. Owing to increased costs since the estimate on which that authorization was based was submitted this amount is not now sufficient for the necessary work. The present location of the fog-signal station on the end of south pier is 1,500 feet inside of entrance to outer harbor. At present the actual entrance between the breakwaters must be found by feeling around in the fog. This subjects vessels to danger of striking the breakwater. The commerce of Ludington, which includes important car-ferry lines across Lake Michigan, is as important as any other port on the east shore of Lake Michigan, and as this port is very inadequately lighted now this improvement is considered well warranted. It is proposed to establish a main light on the outer end of the north breakwater, with fog-signal apparatus, consisting of electrically driven air compressor and compressed air fog signal with oil engine reserve drive, and to discontinue the present steam fog signal in old wooden structure. Quarters for keepers are to be erected adjacent to the light, as it is unsafe to cross the harbor during the winter and when the ice is constantly broken up by car ferries. The present dangerous condition should be corrected as early as practicable. Authorization of this item in the increased amount estimated is pending in House bill 6915 (67th Cong., 1st sess.) but has not been enacted. The pressing necessity for these improvements has been emphasized by the collision on February 10, 1922, of the Pere Marquette Car Ferry No. 18, with the North Breakwater at Ludington, Mich., destroying the superstructure of the timber breakwater to a depth of 10 to 12 feet below water level and for a length of 20 feet or more. This collision occurred in a dense fog and in all probability would not have occurred had a fog signal been located on the outer end of North Breakwater as proposed. Detailed estimate:

North Breakwater (main light):

Reinforced concrete foundation, approximately 24 by 24 feet by 20 inches high, 427 cubic yards, at \$30 per cubic yard.....	\$12,810
Steel tower, concrete lined, base 15 feet square, top 10 feet square, 40 feet high, 6,480 cubic feet, at \$1.25 per cubic foot.....	8,100
Cast-iron lantern house, fourth order.....	1,900
Fog-signal house, brick and tile, 18 by 33 by 14 feet, at 60 cents per cubic foot (8,500 cubic feet).....	5,100
Foundation for fog-signal house, 60 cubic yards concrete, at \$12 per cubic yard.....	720
Fog-signal apparatus.....	17,770
Illuminating apparatus, fourth-order lens with electric light.....	2,500

Total, North Breakwater..... 48,900

South pier:

Concrete foundation.....	600
31-foot steel tower.....	400

North pier:

Concrete foundation, 30 cubic yards, at \$20 per cubic yard.....	600
31-foot skeleton tower.....	1,200
1,000-foot electric transmission pole line.....	500
300-millimeter lens lantern and electric light.....	300

Keepers' dwelling:

New lot.....	500
Three-family house, tile and concrete, 45 by 40 by 30 feet, 54,000 cubic feet, at 36 cents per cubic foot.....	19,500
Outbuildings.....	1,000
Sidewalks, grading, fences, shore protection, etc.....	1,500

Grand total..... 75,000

No. 11. *Florida, west coast, repairs and improvements.*—Repairing, rebuilding, and improving structures at Egmont Key Depot, and light stations in that vicinity, \$34,200.

NOTE.—The act of March 20, 1922 (42 Stat. 443), appropriated \$60,000—50 per cent of the estimated amount—for repairing, rebuilding, and reestablishing aids to navigation and structures connected therewith that were damaged or destroyed in the storm of October 24–26, 1921. These funds will be used for repairing and rebuilding the aids to navigation which are most urgently needed. However, additional funds will be required to repair and rebuild structures, and make needed improvements at Egmont Key Depot, and at light stations and lights, which were damaged or destroyed by storm referred to, or which are seriously deteriorated from age or badly in need of repairs and improvements which it has been impossible to make during the past years for lack of funds. The wooden section of the outer end of wharf at Egmont Key Depot is now so bad that it is dangerous for the tender *Ivy* to lay there during rough weather. Detailed estimate:

Egmont Key Depot, Florida:

Replace wooden section of outer end of dock with iron pile dock, 2,500 square feet at \$12 per square foot.....	\$30,000
Replace three cypress water tanks, with piping, at \$500 each.....	1,500
Minor repairs to depot storehouse.....	500
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	32,000

Egmont Key Light Station, Florida:

Repairs to dwelling.....	1,700
Repairs to concrete walks.....	500
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	2,200

Grand total..... 34,200

No. 12. *Sandusky Bay, Ohio, aids to navigation.*—Constructing a light and fog signal at the entrance to, and improving existing aids to navigation, Sandusky Bay, Ohio, \$105,000.

NOTE.—The act of June 17, 1910 (36 Stat. 536), authorized the establishment of a light and fog signal at the entrance of Sandusky Bay, Ohio, at a cost not to exceed \$80,000, but no appropriation for the project has been made. The need of more efficient aids to mark the entrance to this harbor has been long recognized by marine interests. The entrance is especially difficult to locate in thick weather, and an adequate fog signal is therefore essential. The east jetty is being extended, and a pierhead for the lighthouse foundation at its outer end has been constructed by the United States Engineer Department only to the level of low-water datum. The top of pierhead is therefore about 2 feet below present water level. This necessitates prompt action toward construction of the remainder of the pierhead and station superstructure by the Lighthouse Service. Quarters for at least two additional keepers will be required when the new station is completed. Space for same is available on site already owned by the Lighthouse Service in the immediate vicinity. It is also proposed to replace the present frame structures of the inner and outer ranges with steel towers and install an electrical system to operate these lights and the proposed light and fog signal at the end of the jetty. Sandusky is one of the most important ports of Lake Erie, and its lake commerce is extensive. In 1919 the commerce amounted to over 2,000,000 tons, valued at \$16,600,000. There is also a very considerable passenger traffic. Detailed estimate:

Reinforced-concrete base, 1,000 cubic yards, at \$22 per cubic yard.....	\$22,000
Removing old structures and surfacing piers.....	4,880
Steel-tower metal work, 90 tons, at \$250, in place.....	22,500
Power house, 10,000 cubic feet, at \$0.48 per cubic foot.....	4,800
Fog signal and illuminating installation.....	20,320
Submarine cable, 16,900 feet, at \$1.....	16,900
Dwelling, 30,000 cubic feet, at \$0.46 per cubic foot.....	13,800

Total..... 105,200

No. 13. *Fairport Harbor, Ohio, aids to navigation.*—Completing improvements of the aids to navigation at Fairport Harbor, Ohio, \$39,400.

NOTE.—The act of June 12, 1917 (40 Stat. 161), appropriated \$42,000 for improving aids to navigation at Fairport Harbor, Ohio. This estimate contemplated the construction of a new lighthouse on the west breakwater pierhead and installation of a compressed air fog signal. The steel structure has been erected on the site, including the lantern, but very little of the interior work has been completed. A temporary light is maintained on the structure. The work is now at a standstill owing to lack of funds. Owing to the increased cost of all materials and labor since the original estimate the appropriation is insufficient to carry out the project. Upon completion of the new structure an additional keeper will be required, making three in all. Quarters are now provided for only one keeper. An item has therefore been included in this estimate to cover remodeling the old dwelling and building a new double dwelling, providing quarters for the three keepers. Detailed estimate:

Remodeling old dwelling.....	\$3,500
New double dwelling, 30,000 cubic feet, at 46 cents per cubic foot.....	13,800
Completing new structure, including brickwork, plastering, painting, woodwork, plumbing, etc....	6,600
Illuminating apparatus, installed.....	4,000
Fog-signal apparatus, installed.....	5,900
Boathouse, boats, and accessories.....	4,000
Razing old tower.....	1,600
Total.....	39,400

No. 14. *Erie Harbor, Pa., aids to navigation.*—Improving aids to navigation at Erie Harbor, Pa., and vicinity, \$38,500.

NOTE.—There are three lights and a fog bell on the north pier at Erie Harbor, a steam fog signal located on the beach about 1½ miles north, and a flashing light on the north shore of Presque Isle Peninsula about 1½ miles west of the steam fog signal. The steam fog signal is not needed, and is disadvantageously situated, and may be discontinued. The rear range light, No. 2 at the north pier must be replaced, as the mast supporting it is decayed; the keepers' boathouse and its cribwork is also decayed and must be rebuilt. The storm of April 2, 1922, broke through and carried away a large section of the jetty protecting the shore line of the Presque Isle Light Station. This jetty is a vital protection to the reservation area, which without it would be rapidly decreased by the action of the water. It is proposed to rebuild the boathouse, erect a steel tower for the range light, and move the fog-signal plant some 500 feet easterly toward the shore to an effective location. Electric power can be brought to the station without difficulty, and it is proposed to install a modern compressed-air fog-signal plant in place of the present steam whistle, thus providing a more powerful signal with instantaneous operating control at the north pier. It is proposed to install electric light in the three lights at the north pier and at Presque Isle Light Station, where a great increase in the intensity of the flashing light will be obtained; also to utilize the current for other improvements in aids. It is proposed to rebuild the damaged jetty with stronger construction to withstand the weather. Detailed estimate:

Moving fog-signal building and establishing it on a new foundation about 500 feet eastward:	
Concrete foundation in place, 80 cubic yards, at \$18 per cubic yard.....	\$1,440
Moving and establishing structure on foundation.....	2,400
	3,840
Additions for power house and control station, 3,000 cubic feet, at 86½ cents per cubic foot.....	2,600
Transmission line for four lights and a fog signal, 20,000 linear feet, at 38 cents per linear foot.....	7,600
Fog-signal installation in duplicate.....	13,400
Submarine cable in place (1,200 linear feet, at \$2 per linear foot).....	2,400
Temporary signal maintenance during operations.....	780
	26,780
Steel tower range light, No. 2:	
Concrete in place, 40 cubic yards, at \$15 per cubic yard.....	600
Steelwork in place, 3½ tons, at \$240 per ton.....	840
	1,440
Rebuilding damaged jetty, 6,000 cubic feet stone-filled cribwork, at 54 cents per cubic foot.....	3,240
Rebuilding boathouse, 10,000 cubic feet, at 32 cents per cubic foot.....	3,200
	6,440
Grand total.....	38,500

No. 15. *Marquette Light Station, Mich.*—Improving Marquette Light Station, Mich., \$15,000.

NOTE.—The breakwater at Marquette Light Station originally consisted entirely of a concrete structure and was marked at its outer extremity by an electric light and an electrically operated fog bell. An extension of the breakwater 1,500 feet in length and making an angle with the concrete breakwater has been completed by the United States Engineer Office, the latter structure being of rough stone construction. Its outer end is now marked by a gas buoy, and the electric light and fog signal remains in the old location now marking an angle in the breakwater. It is very necessary that the outer end of the breakwater be marked with a suitable fog signal and a more powerful light. It is proposed therefore to construct a suitable concrete foundation on the end of the stone breakwater, move the present steel tower to that point, install an air diaphone and an electrically operated air compressor connected by cable to shore. Without a proper fog signal at the extreme end of the breakwater, mariners unfamiliar with the locality are very liable to come into collision with the new extension. The stone breakwater extension has been constructed a sufficient length of time that it can now be built upon, it is thought, without danger of settlement. Detailed estimate:

Concrete, including reinforcing, 300 yards, at \$25.....	\$7,500
Moving present tower to outer end of breakwater.....	850
Electric cable and wire in place.....	2,100
Electrical equipment.....	750
Fog-signal equipment installed.....	3,800
Total.....	15,000

No. 16. *Grays Harbor Light Station*.—Improving Grays Harbor Light Station, Wash.. \$20,000.

NOTE.—The present steam plant installed in a frame building at this station is in very bad condition, as is also the building itself. A new plant should be installed as soon as possible. It is proposed to construct a new fireproof building and install therein suitable machinery compressing air which will be delivered by a type "F" diaphone which will be placed in an elevated tower at the shore line about half a mile from present signal. The work will be done by contract, this being considered the most economical and advantageous method. Detailed estimate:

Excavation and grading, 100 cubic yards, at \$2.50.....	\$250
Concrete signal tower at shore line, 8 by 8 by 30 feet, 1,920 cubic feet, at \$2.....	3,840
Concrete power house, 20 by 20 by 14 feet, 5,600 cubic feet, at \$1.....	5,600
Fog-signal apparatus.....	7,610
Pipe line, 2,700 feet, at \$1.....	2,700
Total.....	20,000

No. 17. *Ediz Hook Light Station, Wash.*—Improvements at Ediz Hook Light Station, Wash., \$12,000.

NOTE.—The storm of November 26, 1920, carried away the wharf, boathouse, and approach belonging to the subdepot at this station. The work of the service has been greatly handicapped by the loss of this wharf, which formed a landing place for buoys and appendages and for light-vessel moorings. It is proposed to reconstruct the wharf on the former site but to increase its dimensions; the storage space on the former wharf was insufficient. Also to construct a new boathouse and substantial approach connecting with the present storage platform and buildings ashore. It is also intended to place rock around the piling of wharf and approach to prevent the scouring which undermined the former wharf. Detailed estimate:

Wharf, 30 feet by 100 feet, 3,000 square feet, at \$2.20.....	\$6,600
Approach, 25 feet by 100 feet, 2,500 square feet, at \$1.20.....	3,000
Boathouse, 5,000 cubic feet, at \$0.08.....	400
Enrockment, 720 cubic yards, at \$2.75.....	2,000
Total.....	12,000

GROUP NO. 2.

Works considered essential for the needs of navigation and the equipment of the Lighthouse Service, and which it is recommended be undertaken as resources permit, are submitted with estimates of cost.

FIRST LIGHTHOUSE DISTRICT.

Tumbler Island Light, Me.—Establishing a light at or near the westerly end of Tumbler Island, entrance to Boothbay Harbor, Me., \$5,800.

NOTE.—The need of a light on Tumbler Island has long been felt and expressed by mariners and others interested. A petition having the names of 196 persons was presented to the Lighthouse Service in 1916. Several vessels have been badly damaged by running on Tumbler Island and one life lost. A light properly located would very much facilitate entering the harbor at night and greatly reduce the hazard.

Otter Island Light, Me.—Establishing a light on Otter Island, Muscle Ridge Channel, Me., \$3,600.

NOTE.—A light at this point has several times been petitioned for. Muscle Ridge Channel is much frequented by vessels of all classes except those of deep draft, especially by steamers carrying large numbers of passengers. Passenger traffic through the channel is very heavy in summer. Several vessels have been wrecked in Muscle Ridge Channel in recent years, among them the steamer *City of Rockland*, in the summer of 1904. It is proposed to establish an acetylene light.

Ram Island Light, Me.—Establishing a light on Ram Island, lower Kennebec River, \$6,000.

NOTE.—The need of this light has several times been expressed by petition. Ram Island is about 5½ miles below Bath, Me. It is a low island in the middle of the river, with a string of half-tide ledges making off on the easterly side. There is a passage on either side, and at some stages of the tide a 5-knot current exists, from which several accidents have occurred. According to 1919 statistics about 126,000 tons of freight passed this island in that year, and in addition many pleasure craft and small boats frequent the river. It is proposed to establish an acetylene light on or near the easterly side of Ram Island.

Depot for first lighthouse district.—Purchasing site and constructing and equipping a lighthouse depot in the first lighthouse district, \$180,000.

NOTE.—The present depot at Little Diamond Island is inconveniently located, there being practically no boat service between it and Portland for about half the year. It is expensive to maintain; protection against fire is also a consideration. If a depot could be established on the water front of the city of Portland, the rent of wharf and sheds for tenders, shops for carrying on the repair work of the district, and for office of superintendent would be eliminated. The upkeep of the proposed depot would be less than the cost of the present arrangement by the purchase of a filled wharf, if possible. The sale of the present depot would likely offset considerable of the cost of a new one.

Rockland Lighthouse Depot, Me.—Constructing and equipping a lighthouse depot, at Rockland, Me., in the first lighthouse district, \$28,600.

NOTE.—The two depots in this district are Little Diamond Island and Bear Island, which are about 100 miles apart. Owing to the many rivers, bays, and estuaries between these places considerable more buoy work is required between the two depots than beyond them. Therefore, if a central place could be established between the two depots where buoys and appendages could be stored, repaired, and painted, the work of the district would be greatly facilitated. The great obstacle to this project has been to find a suitable place having some natural advantages in order to reduce the initial cost and unkeep of such a depot.

SECOND LIGHTHOUSE DISTRICT.

Woods Hole Lighthouse Depot, Mass.—Dredging off a point to give entrance to Little Harbor, Woods Hole Depot, Mass., \$18,000.

NOTE.—The bar through which the channel was dredged in 1917 has again filled in, and it is believed that it is impracticable to maintain a channel through this bar, owing to the excessive current. By cutting off the point referred to and following the natural course of the channel it is believed that no difficulty from filling in will be experienced at this point in the future.

Riprap protection for light stations, second lighthouse district.—Providing riprap to protect foundations of light stations from damage by sea and ice in the second lighthouse district, \$17,250.

NOTE.—Practically all these stations are on submarine sites and are subject to damage from sea and ice. Riprap is needed for the first light mentioned to provide a foundation for an acetylene light. The foundations of the other stations have been considerably damaged and weakened by ice during past winters and should now be protected by riprap to prevent danger of their being more seriously damaged in the future.

Cape Cod Light Station, Mass.—Improving fog signal at Cape Cod Light Station Mass., \$5,620.

NOTE.—Owing to the elevated location of the fog signal and to its distance from the shore the present signal has been found inadequate in volume to be readily heard by mariners above the sound produced by the heavy surf on the beach at the station. As this is one of the most important fog signals in this district, it is believed that the establishment of a more powerful signal will meet the needs of the mariner. A petition for this change was received from the maritime interests in December, 1919.

Brant Point Light Station, Mass.—Protecting site of Brant Point Light Station, Mass., from erosion, \$5,000.

NOTE.—Owing to the excessive tide at this point the reservation is being rapidly eroded, and it is believed that an apron of small riprap will stop this.

THIRD LIGHTHOUSE DISTRICT.

Great Salt Pond Light Station, R. I.—Completing light and fog signal on extreme end of breakwater, Great Salt Pond, R. I., \$53,000.

NOTE.—An appropriation of \$20,000 for this work was made by the act of June 12, 1917 (40 Stat. 161), but on account of increase in cost of labor and material and of changing the location to extreme end of breakwater, with foundation in much deeper water than was previously planned, and in order to make this harbor available for submarines, the funds previously appropriated are insufficient and an additional appropriation is required to complete the work, the original appropriation being only sufficient to construct the foundation in the extra depth of water.

Staten Island Lighthouse Depot, N. Y.—Extending and enlarging machine shop at the General Lighthouse Depot, Tompkinsville, Staten Island, N. Y., \$15,000.

NOTE.—The present machine shop is so constructed as to be unadapted for the work which is done in it and will have to be extended and enlarged before it can be made an efficient and economical shop. The act of July 19, 1919 (41 Stat. 213), appropriated \$30,000 for this work, and the act of June 5, 1920 (41 Stat. 1958), authorized \$15,000 additional, but no appropriation has been made therefor. The work can not possibly be done for the \$30,000 appropriated, and \$15,000 additional, or a total of \$45,000, for this work is required.

Staten Island Lighthouse Depot, N. Y.—Improving and extending the wharves at the General Lighthouse Depot, Tompkinsville, Staten Island, N. Y., \$119,600.

NOTE.—The present south wing of north dock is an iron pile dock with wooden top. The piles and steel girders are good, but wooden top is in very poor condition and unsafe. The bulkhead dock is wood throughout and entire dock is poor. The extension to south dock is necessary for storage space for buoys.

Staten Island Lighthouse Depot, N. Y.—Providing new storage buildings and disposition of present inadequate buildings at the General Lighthouse Depot, Tompkinsville, Staten Island, N. Y., \$80,000.

NOTE.—The present storehouse facilities at the General Lighthouse Depot are inadequate, there not being sufficient storage space to permit the purchase of a year's supply of the heavier articles, thus necessitating purchase of many items of supplies in small quantities with a loss of economy. It is proposed to remove the south storehouse, a very old brick building with weak wooden floors, which is considered unsafe, also the old boat shop, and build a new concrete storehouse 100 by 100 feet, four stories high, connecting to present carpenter shop, also build a two-story concrete building 50 by 50 feet to replace present boat shop, for use as a cement shed and storage for depot and field and laborers' tools.

Sag Harbor, N. Y., aids to navigation.—Establishing acetylene lights in the channel leading into and in the vicinity of Sag Harbor, N. Y., and improving Sag Harbor Breakwater Light, and other aids to navigation in that vicinity, \$58,500.

NOTE.—The channel is crooked, narrow, and rocky, and a system of lights to mark turns in channel and so located that vessels can run from light to light is badly needed. The Sag Harbor Light, which marks the entrance of the harbor, is used at long range and is not of sufficient power of light for the purpose. The new lights will be flashing acetylene lights with steel towers, so called, on concrete and riprap foundations.

Coney Island Light Station, N. Y.—Purchasing necessary land for right of way to the reservation at Coney Island Light Station, N. Y., \$5,000.

NOTE.—This reservation is located on Sea Girt property at Nortons Point, west end of Coney Island. It was purchased in 1889, at which time there were no other buildings or roads in the vicinity, but since then the surrounding property has developed in such a manner as to give the lighthouse reservation no street front and no other means of egress for the occupants. A right of way is urgently needed to meet a bad situation and can only be obtained by the purchase of property priced at \$5,000.

Riprap protection for light stations, third lighthouse district.—Providing riprap to reinforce light stations and constructing and improving boat landings in the third lighthouse district, \$136,000.

NOTE.—The act of July 19, 1919 (41 Stat. 213), appropriated \$150,000 toward providing riprap for light stations in third district, but this amount was only about one-half of the estimated requirements at that time, and it is now found that to complete this work in an adequate manner an additional appropriation of \$190,000 is required.

FOURTH LIGHTHOUSE DISTRICT.

Edgemoor Lighthouse Depot, Del.—Rebuilding wharves and improving Edgemoor Depot, Del., \$52,000.

NOTE.—The wharves at Edgemoor Depot are deteriorating rapidly and are in need of rebuilding from the low-water line up. A concrete retaining wall along the north and east sides of the fill to replace old wooden bulkheads has long been needed. The fill is discharging into the basin, and the need is now urgent. Inside the bulkhead lines there are about 7,900 square feet of surface which have never been concreted and whose usefulness is therefore limited, the wooden construction being badly decayed and in need of early rebuilding or replacement with concrete. The need for a concrete shop building is apparent. Some machinery has of necessity been installed in the wooden storehouse, but lack of heat and danger of fire are objections which should be eliminated as soon as possible by the erection of a modern concrete and steel one-story general shop building for the many requirements of the district.

FIFTH LIGHTHOUSE DISTRICT.

Inland waterway, Norfolk, Va., to Beaufort Inlet, N. C., aids to navigation.—Establishing and improving aids to navigation to mark the improved inland waterway from Norfolk, Va., to Pamlico Sound, N. C., \$92,000.

NOTE.—The work of the United States Engineers on the 12-foot project for inland waterway from Norfolk, Va., to Beaufort Inlet, N. C., has reached a point where it seems certain that a depth of 12 feet throughout will be available in the latter part of 1921. Traffic through this waterway is now increasing, and recent reports indicate heavy traffic when the channel is completed. A thorough and adequate system of marking the waterway should be provided.

Cape Henry Light Station, Va.—Improving Cape Henry Light Station, Va., \$24,300.

NOTE.—This station is the most prominent and frequently visited station in the district, and improvements to grounds and structures should be made, but on account of the cost the service has been unable to complete them from the general maintenance appropriation. The entire reservation requires grading, sewer, and water system. All of the dwellings now on the reservation should be moved to symmetrical positions with respect to tower. It is desirable to change the characteristic of the light at Cape Henry from fixed to flashing, and this can be done most advantageously by operating the light by electricity.

SIXTH LIGHTHOUSE DISTRICT.

Charleston Lighthouse Depot, S. C.—Completing the lighthouse depot at Charleston, S. C., in the sixth lighthouse district, \$50,000.

NOTE.—The act of July 5, 1920 (41 Stat. 1058), authorized this work, but no appropriation was made for it. The act of October 22, 1913 (38 Stat. 244), appropriated \$125,000 toward the purchase of a site and construction of a wharf and buildings and equipment, so far as funds might permit, for a depot for the sixth district. This entire appropriation has been expended, but all the necessary facilities have not been provided. The site itself cost \$60,000 and the wharf \$46,418. Further requirements to complete the depot include repairs to old dwelling or construction of new dwellings for the keeper and assistant keeper, who are required to live on the reservation, additional filling, dredging around wharf, sewer system, walks, roads, oil house, blacksmith shop, additional equipment, etc. A considerable portion of the grounds is now below or only slightly above high water and should be filled to make it available for use. The wharf is overcrowded with spare buoys and buoys awaiting repairs. A portion of the grounds adjacent to the shops should be paved to afford a suitable storage space for these buoys. This project should be completed to enable the district organization to perform its duties more efficiently. In conformity with a policy of rigid economy it provides for repairing an old dwelling house for the two keepers and their families, instead of constructing two new houses for them.

Additional buoys, sixth lighthouse district.—Establishing additional lighted buoys in various harbors and approaches, sixth lighthouse district, \$60,000.

NOTE.—No other type of aid to navigation is so much in demand by mariners as gas lighted buoys. They are highly efficient aids, but are too expensive to be provided in the requisite numbers from ordinary maintenance appropriations. The sixth district needs more of them. Petitions have been received from maritime interests for several buoys of this type, and it is proposed to establish 12 such buoys and purchase 2 additional for spare use.

SEVENTH LIGHTHOUSE DISTRICT.

Depot for seventh lighthouse district.—Purchasing site for and constructing and equipping a lighthouse depot for the seventh lighthouse district, \$225,000.

NOTE.—The act of June 5, 1920 (41 Stat. 1058), authorized this work, but no appropriation was made therefor. The Lighthouse Service storehouse, wooden smithy, and wharf are on property belonging to the Treasury Department, which is situated in the midst of the United States naval station. The wooden storehouse and wharf, which are highly inflammable, are located between the Navy coal sheds and Piers A and B, one of each on each side, and are therefore in an unusually dirty location. The coal dust is practically always in motion, and when the coal conveyors are in operation it blows about in clouds. It finds its way into the depot keeper's quarters and into the storehouse, where thousands of dollars' worth of property is stored, which it is impossible to keep clean. These coal sheds have been erected since the storehouse was built. Furthermore, there are frequently several Navy torpedo-boat destroyers lying alongside at the Navy piers on each side of the depot wharf, which, in addition to causing a great deal of dirt, are a menace to the lighthouse tenders on account of collision. A new site and wharf are now urgently needed for the efficient and economical work of the district. The Navy Department has repeatedly urged the removal of this depot from its present location in the midst of the navy yard.

Tampa Bay, Fla., aids to navigation.—Establishing and improving aids to navigation in Tampa Bay, Fla., \$17,500.

NOTE.—The act of June 5, 1920 (41 Stat. 1058), authorized this work, but no appropriation was made therefor. Tampa is an important seaport with a large and growing commerce by sea. Owing to shallow water in Tampa Bay, deep-draft vessels can reach the city from the Gulf only by means of several comparatively narrow dredged cuts. Provision has already been made for lighting all of the important cuts excepting cut D, for which lights should be provided as soon as practicable, as large vessels must pass through this cut in order to reach Port Tampa.

Lakes Okechobee and Hicpochee, Fla.—Establishing and improving aids to navigation in Lakes Okechobee and Hicpochee, Fla., including building and equipping a launch to attend such aids and purchasing a site and erecting keepers' dwellings, \$85,000.

NOTE.—There are 140 miles of coast line around Lakes Hicpochee and Okechobee. Along this shore and in the back country adjoining it there are many farms, groves, and cattle ranches, and fishing is a very important and profitable business in these waters. The present aids to navigation are inadequate, both in number and in kind, and it is therefore proposed to establish suitable structures equipped with acetylene apparatus for lights; also structures for day beacons. A site and two dwellings will be needed for the two keepers, and a substantial station boat for attending all aids to navigation.

Florida, west coast, repairs and improvements.—Repairing, rebuilding, and improving light stations and aids to navigation and structures connected therewith on or near the west coast of Florida, \$33,800.

NOTE.—This item is for completing repairs and rebuilding of light stations and other aids to navigation in the seventh lighthouse district that were damaged or destroyed in the storm of October 24-26, 1921, with such improvements as are found appropriate and advantageous in carrying out the work. Sixty thousand dollars was appropriated for this general purpose in the act of March 20, 1922 (42 Stat. 446), and an additional amount of \$34,200 is recommended in Group 1, item No. 11, of this report.

Florida Reefs and Keys, Fla., aids to navigation.—Establishing additional aids to navigation for Florida Reefs and Keys, Fla., \$185,000.

NOTE.—On account of the unusually difficult and dangerous conditions encountered by vessels navigating near the Florida Reefs, especially by vessels bound into the Gulf of Mexico, which pass close to the reefs to avoid adverse Gulf Stream current, additional lighted aids are urgently needed. A very large and growing commerce is carried through the Straits of Florida and numerous strandings and wrecks, involving large losses, have occurred in the past. These reefs, owing to their nature, are a grave danger to navigation. They rise steeply from the deep channel of the Straits of Florida and the lead is therefore of little assistance. They lie far from shore, and at night the mariner must rely almost entirely upon artificial aids to guide him clear. It is therefore proposed to provide five intermediate lighted aids, which will greatly decrease the present dangers of navigation in that vicinity.

EIGHTH LIGHTHOUSE DISTRICT.

Depot for eighth lighthouse district.—Constructing and equipping a lighthouse depot for the eighth lighthouse district, at New Orleans, La., or vicinity, \$132,750.

NOTE.—The act of June 20, 1918 (40 Stat. 608), authorized this work in the sum of \$83,500, but no appropriation was made therefor. A lighthouse depot at New Orleans, La., is of great importance for the convenient and economical administration of the district. It should be at district headquarters, where supplies and materials are readily available and where shipments by rail and steamer could be received and accumulated for distribution by tender or other means at the proper time. The lamp shop should be located at this depot, as at present all intercourse with the mechanic in charge is by mail and telegraph, which is an inefficient method and the cause of numerous delays, and the present quarters are crowded, inadequate, and badly located. The stores and supplies, excluding buoys and appendages, should be

under the eye of the superintendent at all times. The present depot at Port Eads, La., at the South Pass of the Mississippi River, is nearly 100 miles from district headquarters. A desirable site has been secured for the proposed depot, through a permit from the Treasury Department, to use a portion of the river frontage outside of the levee at the Marine Hospital, New Orleans, La. Material increase in the cost of labor and materials, notwithstanding some recent decreases, necessitates an increase over the original estimate for this project which was submitted in 1917.

Sand Island Light Station, Ala.—Constructing keeper's dwelling and appurtenant structures at Sand Island Light Station, Ala., \$12,000.

NOTE.—The act of July 1, 1918 (40 Stat. 686), appropriated \$37,000 for improvements at this station which does not include the construction of dwelling. It is now estimated that a dwelling and appurtenant structures will cost \$12,000. This provides for a two-story dwelling, comprising living room, dining room, kitchen, bath, and three bedrooms of approximately 170 square feet floor space each room.

NINTH LIGHTHOUSE DISTRICT.

Virgin Islands, West Indies, aids to navigation.—Establishing and improving aids to navigation in the Virgin Islands of the United States and adjacent waters, West Indies, \$40,000.

NOTE.—The act of June 20, 1918 (40 Stat. 608), authorized this work in the sum of \$50,000, but no appropriation was made therefor. By Executive order of July 20, 1917, the lighthouse service in the Virgin Islands, West Indies, acquired by the United States by treaty from Denmark, was transferred to and placed under the jurisdiction of the United States Lighthouse Service. The aids to navigation in these islands are not extensive and will require additions and improvements to make the waters safe and to provide for increasing commerce. It is proposed to provide four unwatched gas lights, five new buoys, as well as additional aids as may be necessary after further study and developments, and to place existing lighthouse property in a good condition of repair. The governor of the Virgin Islands, on July 15, 1919, wrote the Secretary of Commerce urging the importance of improvement of aids to navigation in the Virgin Islands.

Port Real (or East Point, Vieques Island) Light Station, P. R.—Establishing a light station at or near Port Real, P. R., or East Point, Vieques Island, \$40,000.

NOTE.—The lighthouse at Port Ferro, on the south coast of Vieques, or Crab Island, is one of the primary seacoast lights of the Porto Rican system. The light tower and the keepers' dwelling attached to it are built on top of a rocky promontory undermined for some time by the sea, and the whole structure, already dangerously cracked, is in danger of collapsing. It is urgent to rebuild a lighthouse at or near this point, as this is an important aid to the navigation from St. Thomas to Cuba and other West Indian Islands and the Caribbean Sea. A light in this vicinity is necessary for navigation.

San Juan Lighthouse Depot, P. R.—Constructing an office building at the San Juan Lighthouse Depot, P. R., \$27,000.

NOTE.—The office of the ninth lighthouse district is in a building owned by the War Department. A revocable lease for the use of this building has been granted to the Department of Commerce. The United States Engineer Office of the War Department needs the building for its operations. At any time the lighthouse district may find it necessary to seek other office space, so that it is expedient that the construction of a proper office building located within the depot area belonging to the Lighthouse Service be undertaken at the earliest possible date.

TENTH LIGHTHOUSE DISTRICT.

Oswego Harbor, N. Y., aids to navigation.—Improving aids to navigation and removing old structures at Oswego Harbor, N. Y., \$13,000.

NOTE.—The present fog bell at this station is inadequate. Petitions for a more powerful fog signal have been received from marine interests. It is proposed to carry electric power to the station by means of a submarine cable and install a compressed-air fog signal. There is an old stone lighthouse tower, no longer used, located at the angle in the inner breakwater. The cribwork surrounding this tower is in the custody of the Lighthouse Service and is in a dilapidated and damaged state. The maintenance of this cribwork with lighthouse funds is no longer warranted, although it still forms part of the protection works of the harbor. The War Department has indicated it will take over the care and custody of the light house pier upon removal of the stone structure referred to, and an item for that purpose is included in the estimate. Severe storms are causing additional damage to the cribwork, and it is uncertain as to how soon the foundation of the tower will be endangered.

Charlotte Light Station, N. Y.—Improving Charlotte Light Station, N. Y., \$46,000.

NOTE.—This station consists of a low frame tower with fog-signal house addition on outer end of west pier, Charlotte Harbor. The fog-signal house is a frame structure covered with corrugated iron, the floor is concrete, with timber sills resting on concrete piers. The sills are decaying and extensive repairs are urgently necessary. It is proposed to provide a more suitable and permanent structure of steel construction for this station with a higher tower. This will increase the efficiency of the light, as there are numerous lights on shore forming the background. It is also proposed to bring electric power to this station from shore and install an electric air compressor with an improved fog-signal instrument, one of the present oil engine compressors to be retained for emergencies.

Thirty-Mile Point, N. Y., aids to navigation.—Establishing and improving aids to navigation at Thirty Mile Point, N. Y., \$32,500.

NOTE.—Thirty-Mile Point Light Station is a turning point for vessels bound to or from the Welland Canal, and a fog signal is needed for the guidance of such vessels. The establishment of this aid has been repeatedly recommended by the shipping interests. The dwelling originally intended for one family must be enlarged, or a separate dwelling for one of the families should be provided.

ELEVENTH LIGHTHOUSE DISTRICT.

West Neebish Channel, St. Marys River, Mich., aids to navigation.—Establishing and improving aids to navigation West Neebish Channel, St. Marys River, Mich., \$50,000.

NOTE.—There has long been a demand from vessel interests for range lights in the West Neebish Channel to mark the axis of the upper reaches of this channel. During the past three or four years the ice action in the spring has been so severe as to destroy a number of the permanent structures, making their reconstruction or replacement with floating gas buoys necessary. There are now five of these permanent structures replaced by buoys and two more have been completely rebuilt. The result of replacing so many fixed pier lights with gas buoys has been that there is a considerable period both at the opening and close of the navigation season when ice is running when the buoys have to be removed, leaving the channel very poorly marked. Range lights would make safe navigation possible under these conditions, as they could be maintained in commission and their construction and maintenance would cost less than to rebuild all pier lights now replaced by buoys.

Michigan Island Light Station, Wis.—Establishing and improving aids to navigation at or near Michigan Island, Lake Superior, Wis., \$85,000.

NOTE.—The act approved May 27, 1908 (35 Stat. 332), appropriated \$2,000 to make a survey and estimate of the cost and report upon the feasibility and need of establishing a light and fog signal upon Gull Island, or the easterly end of Michigan Island, Apostle Group. As a result of this survey the conclusion has been reached that the eastern end of Michigan Island is the better site. The act of June 17, 1910 (36 Stat. 536), authorized the construction of a light and fog-signal station at Michigan and Gull Islands at a cost not to exceed \$140,000, but no appropriation has been made therefor. A further study indicates that the best plan is to elevate the present light near the westerly end of Michigan Island, add a fog signal, and establish a nonattended acetylene light on Gull Island. This arrangement would serve as a better guide to vessels passing in either direction. The project now contemplated will not cost as much as the amount authorized.

Portage Lake and River, Mich.—Establishing and improving aids to navigation in Portage Lake and River, Mich., \$70,000.

NOTE.—The fog-signal plant at Portage Lake Ship Canals Light Station will require to be removed at an early date, and it is proposed to replace it with a modern diaphone air signal operated by air compressors and to establish a minor diaphone signal on the extremity of the west breakwater, the latter being electrically operated. This arrangement provides a powerful signal for use of vessels in locating the harbor and a minor signal to actually guide them into the entrance. On account of dredging away of the outer extremities of the two inner piers it is necessary also to make changes in the pier lights. Other needed improvements are contemplated also.

Lake of the Woods, Minn., aids to navigation.—Establishing aids to navigation in Lake of the Woods, Minn., \$7,000.

NOTE.—Additional lights to aid navigation on the Lake of the Woods have been urged by local interests for some time, and the establishment of three new lights to mark points of danger are proposed. The Canadian Government maintains about nine lights at different points on the Canadian side of this lake.

TWELFTH LIGHTHOUSE DISTRICT.

Lansing Shoal Light and Fog-Signal Station, Mich.—Establishing a light and fog-signal station at Lansing Shoal, Mich., \$300,000.

NOTE.—This dangerous shoal, which is now marked by a light vessel, is located at the most important point on the northerly passage to and from the Straits of Mackinac. Maritime interests are urgent in their requests for a better light and a more adequate fog signal, located on a fixed crib. The light vessel is compelled, by reason of ice conditions, to be off her station in the early spring and late fall. The important commerce through this passage, both before the light vessel has been placed on her station and after she is compelled to leave it in late fall, fully warrants that a permanent first-class light and fog signal, rather than a light vessel, be used in this passage. The annual traffic past Lansing Shoal averages not less than 25 to 30 million tons, which, reduced to vessel passages on the basis of an average load of 5,000 tons, which is a fair average for traffic on Lake Michigan and Green Bay, would indicate the annual passage of approximately 5,000 vessels in this vicinity.

Sturgeon Bay, Wis., aids to navigation.—Establishing aids to navigation and improving existing aids at or near Sturgeon Bay, Wis., \$49,000.

NOTE.—The aids now in use for the channel through Sturgeon Bay especially north (or west) of the bridge, are inadequate, obsolete as to position, and in an advanced state of decay. It is proposed to discontinue the two Dunlap Reef Lights, as they are practically of no use at the present time; also discontinue the Hills Point daymark, Hills Point Gas Buoy No. 3, and Sturgeon Bay Entrance Gas Buoy No. 1. It is proposed to establish one new acetylene light on Hills Point, near site of present daymark, and three new acetylene lights on cribs—one located at northerly end of Dunlap Reef, one on the east side of the channel, about 2,800 feet southeasterly of Hills Point, near site now occupied by Hills Point Spar Buoy No. 5, and one located on the east side of the channel, about 4,500 feet northerly from Hills Point, near site now occupied by Sturgeon Bay Entrance Gas Buoy No. 1.

Escanaba Light Station, Mich.—Improving light and fog signal and constructing and improving dwellings, Escanaba, Mich., \$70,000.

NOTE.—The port of Escanaba (and Gladstone) is one of the most important on Lake Michigan, shipping about 7,000,000 tons of iron ore each season and having coal, grain, and package freight commerce of importance. The light was located on its present site at inner end of Sand Point in 1868. This point is now marked at outer end by Sand Point spar buoy No. 3. The fog bell, operated by hand-power machine, located 1,400 feet from the outer end of the point, is of very little value to the important commerce carried in boats of largest size. It is proposed to make adequate improvements to meet the requirements of present conditions.

Two Rivers, Wis., pierhead.—Improving light and fog signal at Two Rivers, Wis., \$7,400.

NOTE.—This station is now equipped with an electrically-operated fog bell and sixth-order lens illuminated by wick oil light. For several years past there has been an insistent demand from Two Rivers that the fog signal be improved, owing to the fact that craft operating out of Two Rivers found the bell of little assistance in making the port during fog. As it is necessary to maintain two keepers to operate the bell, the operating expense will be increased but little if an adequate and efficient signal is installed.

Manitowoc Breakwater Light Station, Wis.—Construction of dwellings for the keepers at Manitowoc Light Station, Wis., including authority for disposition of certain of the present lighthouse property in Manitowoc, Wis., \$17,500.

NOTE.—The present dwelling used by two of the three keepers is badly located, as the view of the harbor is now entirely cut off by the present surrounding buildings. The dwelling is on the lot where stood the original Manitowoc lighthouse tower, located in 1840, which was razed in 1895. In order to facilitate the work of the station and make the service more efficient, purchase of a new lot is under way. This lot is located close to shore of lake on high ground at the inner end of the north breakwater. From dwellings located on this new lot the keepers will be able to overlook the aids in the harbor and give more efficient and economical service in their operation.

SIXTEENTH LIGHTHOUSE DISTRICT.

Ketchikan Lighthouse Depot, Alaska.—Completing the lighthouse depot at Ketchikan, Alaska, in the sixteenth district, \$65,000.

NOTE.—The act of July 1, 1918 (40 Stat. 687), appropriated \$90,000 for a lighthouse depot and the necessary equipment for the sixteenth lighthouse district. This appropriation was supplemented by an item of \$12,000 contained in the deficiency appropriation bill approved March 6, 1920 (41 Stat., 516). All funds appropriated have been expended. A wharf has been completed and a reinforced-concrete storehouse erected. The latter has been provided with a temporary roof and is being used. A permanent roof should be provided, however, and the building should be otherwise completed and fitted for the purpose intended by installation of partitions, fixtures, freight elevator, shelving, etc. Other buildings and equipment are needed in order to complete the depot and provide suitable facilities for handling stock and carrying on the work of the station with dispatch and in an efficient and economical manner. Separate buildings are needed for carpenter shop, boat shop, and blacksmith shop. The grounds adjacent to the wharf and buildings should be graded and roads and pavements constructed. A dwelling should be erected on the premises for the depot keeper, as the site is on the outskirts of the town where no living quarters are available for rental and the keeper can render greater service if he resides permanently on the grounds.

SEVENTEENTH LIGHTHOUSE DISTRICT.

Washington and Oregon, aids to navigation.—Establishing and improving aids to navigation in the States of Washington and Oregon, \$50,000.

NOTE.—The urgent demand for more and better aids has exhausted the special appropriation heretofore made, and current appropriations for the operation of the district are insufficient to provide for new buoys and minor aids urgently demanded throughout the district.

Bush Point Light Station, Wash.—Establishing a light and fog-signal station at or near Bush Point, Puget Sound, Wash., \$46,000.

NOTE.—This is a low point, and the currents in the vicinity are strong and irregular. Several serious collisions have occurred between Bush Point and Point No Point through inbound and outbound vessels following the shore of Marrowstone Island during foggy weather on account of the echo which can be obtained from it. This aid was petitioned for by the Shipmasters' Association of America during September, 1918, and was considered by that association as the second most important aid required for Puget Sound.

Alki Point Light Station, Wash.—Improvements at Alki Point Light Station, Washington, \$3,000.

NOTE.—No provision has heretofore been made for a workshop and storehouse at this station, and the need of one is urgent. It is proposed to erect a fireproof building, the work to be done by contract, this being considered the most economical and advantageous method.

Cape Lookout, Oreg., light and fog signal.—Establishing a light and fog signal at or near Cape Lookout, Oreg., \$150,000.

NOTE.—All coastwise masters are unanimous in the demand for a light and fog signal on this cape, and a petition for the establishment of such an aid at this point was submitted in 1920. Cape Lookout is farther westward than any other point of land from Cape Arago to the Columbia River, and is a point which nearly every coastwise vessel running between San Francisco, the Columbia River, Grays Harbor and Shoal Water Bay, and many vessels running to Puget Sound, pass close to in foggy weather to get uniform soundings. Though there is a light at Cape Meares, 8 miles distant, there is no fog signal, and if there were one, it could scarcely be heard, as the station is so far in from the course of vessels. For Cape Lookout a light and fog-signal station, comprising powerful flashing light, high-powered fog signal, quarters for three keepers, oil and storerooms, derrick and tramway, etc., are necessary and are recommended.

EIGHTEENTH LIGHTHOUSE DISTRICT.

Depot keepers' dwellings, Goat Island, Calif.—Construction of two dwellings, at the Goat Island Lighthouse Depot, Calif., \$16,500.

NOTE.—The act of June 5, 1920 (41 Stat. 1059), authorized this work, but no appropriation was made therefor. The present quarters at the Goat Island Lighthouse Depot, consisting of two old frame cottages located at the water's edge, are wholly inadequate to accommodate the depot force. There are no quarters

available for the assistant depot keeper, mechanic, and skilled laborer, all of whom are required to make long journeys to and from San Francisco each day. On account of the position of Goat Island in the middle of San Francisco Bay, with no ferry accommodations except such as can be obtained by means of the naval training station boats, it is essential that all employees at the depot should be housed on the lighthouse reservation, as they are unable to properly carry on their work under present conditions. Orders have recently been issued by the Navy Department to remove the naval training station from Goat Island in the near future, and it is probable that the present launch service to the island will be very seriously reduced with great detriment to the Lighthouse Service. Two dwellings are urgently required to be built on the high ground adjacent to the depot for the accommodation of the keeper and the mechanic in charge of the depot shops.

California, aids to navigation.—Establishing aids to navigation, California, \$25,000.

NOTE.—The act of June 5, 1920 (41 Stat. 1059), authorized this work, but no appropriation was made therefor. Numerous petitions have been received for lighting the channel between Point San Mateo and the mouth of Alviso Slough, San Francisco Bay. This waterway is the natural outlet for nearly all the produce of the extensive Santa Clara Valley, and the annual traffic has been greatly increased on account of the greatly increased demand for this produce. The present channel is narrow and winding, and there are no aids to assist mariners in keeping off the shoals at night. Accidents and strandings are of frequent occurrence. Much of the traffic must be carried on at night to take advantage of the tides. Additional lights are urgently needed and should be established at once. Gas buoys should also be provided at Fort Ross and Point Buchon, on the coast of California; these are necessary for the protection of coastwise shipping. There is an urgent demand for a more suitable lighted buoy at Crescent City, Calif.

During the past year one vessel was lost and another damaged at this entrance. There is a heavy traffic in the north channel of Suisun Bay, and two additional lights and echo boards are necessary.

Goat Island Lighthouse Depot, Calif.—Extending wharf and making other improvements at the Goat Island Lighthouse Depot, Calif., \$73,000.

NOTE.—The present wharf at the Goat Island Depot is inadequate for handling the business of the district. This is the only depot in the district, and all supplies and buoyage for the whole district are handled over the wharf. The wharf was built many years ago when the business of the district was about one-half of what it is at present and when there was only one tender and one light vessel in the district. There are now two tenders and three light vessels in the district, and one-half of the small wharf is constantly occupied by one of the light vessels while relieved for overhauling and repairs. This leaves barely room for one tender to make fast and practically no working room on account of the heavy buoys which it is necessary to keep near the face of the wharf. The work of the district is being conducted at a heavy loss due to delays in handling supplies and loss of time of tenders. It is proposed to extend the present wharf for a distance of 150 feet in a southerly direction at a width of 50 feet, to construct a retaining wall in the rear of the new section, and to fill in an area of about 80 feet by 150 feet behind the wall with the material from the adjacent bluffs. The present warehouse for depot supplies is a poorly constructed and overcrowded frame building over 40 years old. It is badly decayed in places and can no longer be economically repaired. A plain, reinforced, fireproof building 40 by 100 feet and three stories high is required to replace the present dilapidated two-story structure and furnish necessary storage space.

Red Rock Light and Fog Signal, Calif.—Establishing a light and fog signal on Red Rock in the northern part of San Francisco Bay, Calif., \$14,000.

NOTE.—Red Rock is a bold, rocky island in the northern part of San Francisco Bay, rising to a height of 150 feet, with deep water close to its shores. It lies in the path of the very heavy up-bay and up-river traffic, as well as in the path of all craft proceeding to and from the Mare Island Navy Yard, and is also directly in the path of the passenger and automobile ferry steamers plying between Castro Point and Point San Quentin. Requests have been received from the masters of river steamers, of oil tankers, and others to suitably mark this island with a fog signal and light. It is proposed to establish a compressed-air diaphone on the south end of the island and to establish a sixth-order flashing electric light of about 3,200 candlepower.

Point Pinos Light Station, Calif.—Improving Point Pinos Light Station, Calif., \$16,500.

NOTE.—The harbor of Monterey is a regular port of call for coasting steamers operating between San Francisco and Los Angeles. It is also the shipping port for large quantities of crude oil, and some of the largest oil carriers on the coast enter this port regularly. The harbor is also the headquarters of upward of 2,000 large fishing boats. Heavy fogs are frequent at this part of the coast, and at present there is no protection for vessels entering the harbor. Numerous applications have been received from shipowners and shipmasters for the establishment of a fog signal at the light station, and there is a very urgent need for its establishment as soon as practicable. The combined dwelling and tower at this station was built in 1855 and is only sufficient to house the present keeper. An additional dwelling is needed.

Santa Barbara Light Station, Calif.—Improving Santa Barbara Light Station, Calif., \$20,000.

NOTE.—A combined dwelling and tower at this station was built in 1856 and is entirely too small to accommodate the modern revolving lens now installed in it. The tower stands one-eighth of a mile back from the shore line, and the light is at present obscured by trees on adjacent properties. A new tower should be built farther out near the shore line and a first-class compressed-air fog signal installed, with quarters for the additional keeper that will be required. Northbound coasting vessels keep close in shore to avoid the prevailing northwesterly wind and sea, and a fog signal at this point is required. The nearest aid to navigation to the southward is Point Hueneme Light Station, 30 miles distant, while the nearest aid to the northward is the Point Conception Light Station, nearly 40 miles distant. There is heavy traffic through the Santa Barbara Channel at all times, and the distance of 70 miles between adjacent fog signals is too great for the proper protection of navigation.

Piedras Blancas Light Station, Calif.—Improvements at Piedras Blancas Light Station, Calif., \$6,500.

NOTE.—This is a large station, with a first-class fog signal and a first-order light. The keeper occupies a separate dwelling, which was constructed when the fog signal was established, and the three assistant

keepers occupy one two-story dwelling, which was intended for the accommodation of but two keepers. The quarters are dark and very poorly arranged, and the third assistant keeper has but three small rooms widely separated, one being on the lower floor and two on the upper floor. It is necessary in order to maintain decent living conditions to assign the whole building for the use of two keepers as was originally intended. Great trouble has been experienced in keeping assistants on this station on account of the congested condition and the trouble which constantly arises between assistant keepers' families. A new set of quarters for the first assistant keeper is urgently required.

Point Montara Light Station, Calif.—Improvements at Point Montara Light Station, Calif., \$6,500.

NOTE.—This station is one of the most important in the approach to San Francisco Harbor. It is equipped with a flashing light and first-order compressed-air fog signal. Dense fogs prevail throughout the summer months, often lasting several days at a time, and it has frequently been necessary to send additional help to the station to maintain necessary watches, as only two keepers are at present assigned to the station. A third keeper is urgently required to maintain necessary watches and properly care for the work at the station. The present quarters consist of a single two-story dwelling, inadequate in size, poorly arranged, and occupied jointly by the two keepers. An additional set of quarters is required to accommodate a third keeper.

NINETEENTH LIGHTHOUSE DISTRICT.

Hawaiian Islands Lighthouse Depot.—Constructing and equipping a lighthouse depot at Honolulu, Hawaii, \$120,000.

NOTE.—The act of June 5, 1920 (41 Stat., 1059), increased the authorization for this work from \$90,000 to \$120,000, but no appropriation was made therefor. The greatest need in this district is an adequate lighthouse depot. At present the depot is in a temporary rented building, costing \$110 per month, and is subject to vacating on 90 days' notice. This building is about one-third mile from lighthouse wharf, which results in considerable cartage expenses. The present location and building are not suitable for a lighthouse depot. The building is on the lee side of a dusty street, and it is impossible to keep out great quantities of dust. The tenure of this building is very uncertain, and on account of the scarcity of storage room in Honolulu there is no certainty that another storehouse as suitable as this one could be rented even at a high rate. The Lighthouse Service now has the necessary sites for its proposed depot in this district, consisting of half a slip and a small wharf in Honolulu; also 1½ acres on Sand Island across the harbor, which is to be utilized for a buoy depot if needed at a later date. Water and land borings at lighthouse wharf were completed July 6, 1921, and work on preliminary plans will be prepared in the near future. It is proposed to build the present wharf out to the "140-foot" slip line and extend it to the total length of 330 feet, making a total area of about 20,750 square feet, about half of which would be a reinforced concrete wharf on piles. General storehouse, machine and repair shop, oil house, and storage of buoys are to be located on this wharf. With the reduced number of spare buoys in this district, the size wharf here proposed would be large enough to take care of present and near future needs.

Cape Kumukahi Light Station, Hawaii.—Establishing a light at or near Cape Kumukahi, Hawaii, \$28,000.

NOTE.—Cape Kumukahi is the easternmost cape of Hawaii. All vessels plying to Hilo from the Panama Canal must make a landfall of this point. A considerable increase in traffic via Panama Canal direct to Hilo has been announced for the beginning of next year. All interisland traffic in and out of Hilo, the second port of the Territory, via the south and west coasts of the island of Hawaii, must round this point, which is difficult to make. The rapid growth and importance of Hilo with resulting increase in shipping emphasizes the need of a light here, and maritime interests are urging the establishment of this aid. It is proposed to provide a temporary gaslight on this cape as soon as a site can be acquired, but a permanent adequately lighted station is urgently needed at this point, for which this appropriation is asked.

Kauhola Point Light Station, Hawaii.—Improving the light station at Kauhola Point, Hawaii, \$22,000.

NOTE.—A fourth-order flash lens with i. o. v. apparatus is now installed on a temporary frame tower at this station. This is an important landfall station, and it is recommended that the light be raised to a focal-plane height of 110 feet. To support this lantern and lens and complete the improvements at the station, a 72-foot reinforced concrete tower with spiral cast-iron stairway and standard fourth-order round lantern is recommended. A dwelling for the assistant keeper is very urgent.

Total Group No. 2 (not included in estimate), \$3,222,720.

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